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Ideal metrology

in

nature, art, religion

and history.

By

H.G.Wood.

Dorchester.

The Author.

1908.

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IDEAL METROLOGY.

INTRODUCTION.

A DECISION based on circumstantial evidence may be confirmed, modified or wholly rejected. The court of inquiry feels its way through a tangle of facts without being able to forecast the outcome; but at the close of its investigation a judgment is reached that depends upon coincidences, which taken separately would be of little value but taken together clearly determine the result. The judgment of the court is its interpretation of the facts.

When the inquiry relates to the symbolic use of numerals many men show great distrust of any conclusion that is based on numerical coincidences. One says he can take the measures of a table and a bookcase and find any amount of such coincidences; another says these things are of no practical value; another declares that they are accidental and signify nothing, and still another says there is no historical record that the coincidences were designed.

In answer to this distrust I may frankly state that I attach no importance to a mere coincidence, taken

apart by itself, but if it belongs to a system of activities I cannot rightly interpret its meaning and purpose without duly considering the system of which it is a part. The grades, curves, sidings and signals of a railway system are as they are because they were designed so to be; they represent a business ideal of transportation. A passenger may not know the significance of a train whistle, but his life depends upon the quick action of the brakeman who understands the warning. To be of real value and mean something, coincidences must singly and collectively belong to a comprehensive system of facts which are specific revelations of homogeneous activity. Such coincidences appear in the laws of nature, the growth of plants, animals, man and human history, and in the Divine inspirations that have come to us through past ages. Numerical coincidences abound in all these departments. They are the necessary product of God's conception of what creation must be to satisfy His ideal of finite being and action, and cannot be classed as unimportant or of no practical value. What God does means something, whether it be in material or spiritual things. Every detail of His work is a necessary part of the progressive manifestation of His wisdom and love. Creation is a finite revelation of Divine ideals.

By a careful study of physical relations and the systematic coincidences that are displayed in the laws of nature we may come to understand more fully the handiwork of the Master Builder. Much of this is an open book which all may read and reverence; but to trace back to the fountain of being, the veins, arteries

and nerves of this vast system of Divinely ordered activities is a life long work of love and faith. The facts herein presented will not be questioned, but the reader will decide for himself whether to accept, modify or reject the author's interpretation; we seek only truth and right judgment.

CHAPTER I.

IDEALS IN NATU

THE processes of Divine activ[illegible] rfe[illegible] is no afterthought to correct disturb[illegible]ions. E[illegible]y possibility is foreseen from the beginn[illegible] and the pro-cesses continue in their appointed cycles witho[illegible] a fault. It is God's workmanship, the mode or way of Divine activity, to which we give the name Natu[illegible]l Law.

The opening chapter of the Hebrew Scriptures, or Book of Beginnings, presents a philosophy of creati[illegible]n and enunciates the processes, or cycles of Divine acti[illegible]-ity. The unproduced intelligent being is God. The formula of Divine activity is given in the words, L[illegible] there be light. Ages of evolution followed, and t[illegible] earth, with its manifold forms of life, set in one [illegible] many solar systems, was made habitable for man. [illegible] was a product of Divine energy, thought and love, [illegible] finite exhibit of His perfection. He is its life, the li[illegible] of physical relations, the all-pervading FORCE, the li[illegible]ing Energy that inheres in the nature of things. "[illegible] Him we live and move and have our being." Th[illegible] study of physical laws is a study of the order and w[illegible] in which God works.

Creation, as God's work, is supremely accurate in i[illegible] physical relations; but as God's ideal of relations ne[illegible] essary to universal order and living harmony, it is s[illegible] premely spiritual, a sacramental veiling of His omn[illegible]

presence. These physical relations are expressed in mathematical terms. The last analysis of natural processes reveals a mathematical law, it may be in the elliptical orbit of a planet, the pentagonal division of an apple core, the spiral growth of a vine, the form of a honeybee's cell, or the structure of the bones, nerves, muscles, ligaments and tissues of the human body.

Ages long ago men reckoned the cycles of nature by numbers, and numbers became symbols of natural law and of spiritual ideals manifested in nature. Ancient students had a double grasp of the Divine order of things, — it was physical and spiritual. As then so now, the true study of nature is a search for Divine thought, the Divine ideal that is veiled in material forms and relations. Do the mathematical terms that express these relations reveal the ideal? The threads of a woven fabric may not separately exhibit the ideal of its design, but taken together in their orderly relation they do. If we discover intelligible relations in one department of the activities of nature we may well believe that we have touched the ideal of design; but if we find the same ideal in many departments, though modified like the instrumental variations played by the artist in executing a score of music, we may rationally believe in a unity of design coupled with a manifold purpose. The harmony is one throughout.

MUSIC.

For this study of nature we take first the harmony of music, as perhaps the most easily apprehended in numerical form. In music middle C is taken for the

standard of musical pitch. It is defined by the number of its vibrations per second. For many years that number was 256. Haydn's pitch was not so high. Music masters have found the pitch of 256 too high for the average human voice; it had been adopted to secure greater brilliancy in operatic work. The strain was too severe, and now 240 is made the international standard. Harmony in music is based on natural law; it is a mathematical law and no human power can change it. The steps from note to note are mathematical steps. Beginning with 240 for middle C, the scale is without fractions, and runs, D, 270; E, 300; F, 320; G, 360; A, 400; B, 450; C, 480. Any other scale within reach of the human voice involves fractional vibrations. We may therefore say that 240 is the natural pitch, and best suited to vocal purposes. It will be observed that all these vibration numbers are multiples of one or more of the cardinal numbers except 7 which as a numeric symbol signifies rest and in music is silent. The strong note G has 360 vibrations per second, which is a multiple of all the cardinal numbers except 7; tunes in the key of G have great vigor, but lose vitality when transposed to another key. Each key has its own effective ideal. The pathos or solemnity of a tune depends much upon the key in which it is written, while its richness depends upon the choral combination of its tones. The number of vibrations in a chord of the natural scale is a multiple of 3, as C 240, E 300, G 360, total 900. Three, the numeric symbol of harmony, was used by the ancient Greeks as the symbol of divine perfection.

A note with its octaves expresses absolute unity, for the chord is a unison. Two notes, as C and E, make a harmony, but it is by a repetition of the conjunction of sound waves. Three notes, as C, E and G, are a full chord and express the fundamental ideal of harmony. Upon this basis many chords may be produced and even the entire gamut may be comprised in one, though some of the tones will be in different octaves. Under the natural law of harmony music represents ideal harmonies of life and speaks to the responsive soul in a language full of Divine ideals. It is the voice of numbers interwoven by the law of nature to express the deepest and loftiest emotions. It comes from the rhythmic flow of the sea, the winds and the falling waters. The conscious stir of animal life enters into the chorus of song; even amidst the noise of the city's confusion its undertone is felt, in which all sounds are blended and subdued with ever changing cadences. Voices beyond the reach of human ears announce, like a breath of the Infinite, the transformation of cloud-mist into snowflakes, water and earth into growing plants, bud and flower into luscious fruit, food and water into human flesh, and star-dust into suns and worlds. There is no silence in nature save the mystic "half hour" in which the creature reverently awaits the revealed presence of the Most Holy.

COLORS.

Light is recognized as a force in nature, a necessity to reproductive life, but what it is in itself we may let faith answer. In ancient times men reverently asso-

ciated it with, or called it, Divine energy. It is the swiftest of all activities that have come within the reach of human measurement. It has a velocity of nearly 200,000 miles in a second, with a vibratory action of 30,000 to 70,000 waves in the space of one inch. In the music scale one vibration of middle C requires $\frac{1}{240}$ of a second, but the time of one wave-vibration in red is $\frac{1}{400,000,000,000,000}$ of a second. We cannot think of light as a material substance, but rather as an immaterial activity.

The solar spectrum shows that light is a compound of wave motions of different lengths, the longest waves giving the darkest shade of red, the shortest giving a grey effect. The number of waves in one inch is for red 36,000, orange 40,000, yellow 46,000, green 49,000, blue 56,000, violet 60,000, grey 70,000. If these numbers be divided by 150 we have a scale nearly identical with the numeric scale of music:

Red	36,000 ÷ 150 = 240;	C is 240 vibrations per second.
Orange	40,000 ÷ 150 = 266;	D is 270 " "
Yellow	46,000 ÷ 150 = 306;	E is 300 " "
Green	49,000 ÷ 150 = 326;	F is 320 " "
Blue	56,000 ÷ 150 = 373;	G is 360 " "
Violet	60,000 ÷ 150 = 400;	A is 400 " "
Grey	70,000 ÷ 150 = 466;	B is 450 " "

The color standards here given are the result of a practicable adjustment for commercial and artistic use. A softer shade of green, say 48,000, would make its 326 coincide with 320 in the music scale, as red 240 and violet 400 coincide with C and A. From these coincidences we infer that the ideal numeric basis of

color relations is the same as the ideal basis of musical harmony.

The relationship of color and music has other marks. Grey merges into black at the upper end of the scale, and red into darkness at the lower end. So the tones in the higher flight of octaves become silent to the human ear, as also do those of the lower octaves in their descent. Between these extremes the blending of color shades as of music-tones is unlimited except by nature's law of harmony. The greens and yellows are never misplaced in Divine workmanship. The fundamental pitch of nature's choral is 160, the sub-octave of F 320, whose twin sister in color is the softer shade of green, the topaz of pure sunlight, the regal jewel of the tribe of Judah in the Breastplate of Judgment. Color harmony is best secured by the juxtaposition of alternates in the color scale, as musical harmony is by the combination of alternate tones in the music scale. The psychological effect of color is quite analogous to that of music, so that we call the latter bright, fiery, pale, blue or somber. There is chemical activity in one as in the other. The initial gathering of a storm does not resound in our ears, and we know not the existence of the far-away stars till we see their image in the photographic touch of light, the Divine fire of the universe.

As to the characteristic motion of sound and light activity we may safely call it elliptical. If a lower note of the piano be struck from beneath the string, a distinct repetition of taps can be felt above or below, and at a less distance on the sides. The motion of the string is not purely oscillating but elliptical. As the

sound dies away the range of the vibration diminishes, and the motion of a given point on the string is a spiral. The spiral may be the ideal form of all motions in nature, for God's work is progressive, and there is no need that He ever retrace His steps. The chemistry of light may yet bring confirmation of this as a fundamental truth.

MOLECULES.

The ideal of harmony, numerically displayed in music and color, is also found in the molecular relations which chemical elements bear to one another. So far as we know they are seventy in number and are rarely found pure in nature. The law of combination is as fixed with them as it is in musical chords, every element has its unit of combination, which is called its molecular weight or equivalent. In the ascending scale of music a note's octave has double its number of vibrations. The molecular weights of the seventy elements, being arranged on the geometric scale of doubles, exhibit a remarkable likeness to the numeric octaves of music. In the table on the opposite page note vibrations are given by tenths, thus 24 represents middle C 240.

The close coincidences there displayed indicate that harmony, quite like that found in color and music, exists in the relations which chemical elements bear to one another. Since the molecular weight of one element is the proportion in which it combines with another, we may say that the activities which effect a chemical union are akin to those which make a chord in music: sometimes elements mix without union, as

COMPARATIVE TABLE

OF NOTE NUMBERS AND MOLECULAR WEIGHTS.

⅒ C equals....24	⅒ E equals....30	⅒ G# equals...38.4
Car. 12 12	Pho. 31 30	Flu. 19 .....19.2
Mag. 24.3.....24	Nic. 58.7.....60	—— ——.....38.4
Tit. 48.1.....48	Cob. 59	Ar. 75 .....76.8
Mol. 96 96	Tin 119 120	Gad. 156 ....153.6
Os. 191 192	Ant. 120	
Irid. 193	Ur. 239.0....240	⅒ A.....40
Plat. 194.8.....		Pot. 39.1.....40
Gold 197.2.....	⅒ F equals.....32	Arg. 39.9.....
	Hy. 1 1	Cal. 40 .....
⅒ C# equals...25.6	—— ——.....2	Sele. 79.1.....80
Van. 51 .....51.2	Hel. 4 4	Bro. 79.9.....
Chr. 52	Lith. 7 8	Kry. 81.8.....
Ruth. 101.7....103.2	Ox. 16 16	
Rho. 103	Sul. 32 32	⅒ A# equals...42.6
Pal. 106	Cop. 63.6.....64	Rub. 85.4.....85.2
Mer. 200.3....206.4	Zinc 65.4.....	Thu. 170.7....170.4
Thal. 204	Iod. 126.8....128	Yter. 173 .....
Lead 206.9.....	Xen. 128	
Bis. 208.5.....		⅒ B equals....45
	⅒ F# equals...34.1	Bor. 11 .....11.2
⅒ D equals....27	Caes. 133 ....136.4	Nat. 23 .....22.5
Al. 27.1.....27	Bar. 137	Scan. 44 45
Mang. 55 54	Lan. 138	Yttri. 89 90
Silver 108 108		Zir. 90.7.....
	⅒ G equals....36	Col. 94 .....
⅒ D# equals...28.8	Chl. 35.4.....36	Tan. 183 180
Nit. 14 .....14.4	Gal. 70 72	Tung. 184 .....
Silic. 28.4.....28.8	Ger. 72	
Iron 56 .....57.6	Ceri. 140 144	
Cad. 112.4....115.2	Neo. 140.5.....	
Ind. 114	Pras. 143.6.....	
Tho. 232 ....230.4		

discordant notes mix without harmony, and sometimes two elements require a third for a solvent, as two discordant notes become harmonious in union with another.

When two or more elements combine, it can be seen by the table that generally the notes that correspond to those elements constitute a musical chord. If the human ear could discern the sounds produced by chemical action, we might perceive a musical harmony in all forms of living growth.

The sum of the vibrations that make a chord in music is a multiple of three. In like manner the sum of the molecular weights in a chemical combination is a multiple of three; thus water is two parts hydrogen, and sixteen parts oxygen, and the molecular weight is $2 + 16 = 18$; the notes corresponding to hydrogen and oxygen in the table are sub-octaves of F. Phosphate of soda is phosphorus, oxygen and sodium; the weight is 163.8 which is a multiple of three. The molecular weight of a chemical compound of two or more elements is often a multiple of three or even nine. It is found in this way that eighty per cent. of the simple compounds are multiples of three, and correspond to musical chords. Long before the Christian era philosophers and students of nature assigned to the number three ideal perfection and harmony, and used it as a numeric symbol to represent divine perfection in the cycles of natural law.

I have traced a parallelism of activities in musical vibrations, color waves and molecular actions. In these departments of nature systematic coincidences

are unveiled which exhibit not only internal harmony in each department, but a persistent harmony between the departments, harmonies that are correctly expressed in the language of numbers. In doing this I have described and measured the movements and relations of things, not the things themselves. I do not know what hydrogen or oxygen is, — they are called gases, but in changed conditions they become liquids or solids. All gases may become liquid or solid, and all solids may become gases. To my sense and intelligence chemical elements exhibit in their manifold forms and combinations a *resident* force, the results of whose activity I can measure and define, while the force itself escapes my grasp. There is only one way in which I can postulate a satisfactory explanation of the harmony I find in the natural relations of physical phenomena: It is of God the Almighty. He is the intelligent and persistent FORCE, the LIFE of the physical universe whose manifold forms of activity we describe as Laws of Nature.

The supreme stimulant to a persistent study of nature is, not that we may see God face to face, or discover the final analysis of His activity, a feat quite beyond the reach of finite intelligence, but that we may attain to a rational knowledge of Divine ideals, and lovingly adjust our own life and action to the harmony of Divine workmanship. I would say however that the numerical correlations I have traced in physical things are but single aspects of ideals veiled in the perfection of Divine handiwork deeper and more comprehensive than we can grasp. The ideals are of God's own being

and, like Himself eternal, the imperishable thought of Divine Intelligence, of which the universe is a living manifestation.

CRYSTALS.

The physical products of nature are defined as organic and inorganic. This is not a faultless definition, for all things in nature are organized, some by generation, others by accretion. To the former belong activities involving fertility, growth, reproduction, parentage, etc.; to the latter belong concretive forces involving elemental additions according to fixed laws; minerals are of this class; nevertheless they are constantly used by life activities in the production and growth of plants and animals.

"Each mineral, with few exceptions, has its definite form, by which it may be known as truly as a dog or a cat. These forms are cubes, prisms, double pyramids and the like, called crystals, with faces arranged in symmetrical order according to mathematical law." *Dana.*

The dimensions of a fully developed crystal may be several feet or only the small fraction of an inch. A good specimen is measured by the length of its axes, of which there are three, the vertical and two others in angular relation to it and to each other. The point of their intersection is the centre of the crystal; its measurement is along the axial lines. If the crystal is a cube the axes are of equal length and perpendicular to one another. As crystals differ in form the axes may differ in length and angular relation. The innumerable forms of crystallization chiefly due to these differences may be reduced to six groups or systems.

Group.	Axis angle.	Axis length.	System.
I	90°	All equal.	Isometric.
II	90°	Two equal.	Tetragonal.
III	90°	All unequal.	Orthorhombic.
IV	90° and 90°+	All unequal.	Monoclinic.
V	90° ±	All unequal.	Triclinic.
VI	60° and 90°	Two equal.	Hexagonal.

The vibratory action of tones in the musical gamut is in close numerical relation to the action that belongs to crystal formation. This is shown by taking 24, that is, one-tenth of middle C, for a unit in the axial proportions of a crystal. In the following table the first line of each section gives the axial proportions, the second line gives the corresponding multiples of 24, and the third line gives the corresponding letters of the gamut.

AXIAL RATIOS OF CRYSTALS AND MUSICAL CHORDS.

1	1	1	1	5/3	5	1	3/2	3/2
24	24	24	24	40	120	24	36	36
C	C	C	C	A	E″	C	G	G
1	1	2	1	5/4		1	5	5
24	24	48	24	30		24	120	120
C	C	C′	C	E		C	E″	E″
1	2	4	1	2	2	1	4/3	4
24	48	96	24	48	48	24	32	96
C	C′	C″	C	C′	C′	C	F	C″
1	3/2	3	1	1	3			
24	36	72	24	24	72			
C	G	G′	C	C	G′			
1	4	4	1	3	3			
24	96	96	24	72	72			
C	C″	C″	C	G′	G′			

It is obvious that in each of the foregoing cases the letters of the musical scale are a chord. Since a crystal grows by molecular increments it is evident that it is the product of two or more forces bringing the molecules together and holding them in compact relation. When two such forces work in the same plane the crystal is sheet-like in form, but if a third force enters into the structural process the result is a solid. If all these forces are of the same kind and degree and in rectangular relation the product is a cube or some form analogous to the cube, and the crystal is isometric. If the relative activity of these forces be changed the axes become more or less unequal or inclined, and the crystal does not conform to the cubic base. From this preliminary point of view we may say that a crystal is the product of forces acting in different planes and with or without different degrees and kinds of activity, but always in accord with mathematical law.

It will be seen in the foregoing table that the axial relations of a crystal are rational and can be expressed in numeric integers. To secure such relations the forces engaged must work together harmoniously. The fundamental ideal of this harmony appears to be exhibited in the numeric proportions which the axial lengths bear to one another. The table shows that the axes of a crystal stand numerically not only in a rational but in a musical relation. Crystallization therefore is one of the many processes in the physical world which reveal the Divine ideal of harmony.

GRAVITATION.

Passing now from earth to the great solar system in which it moves, we find the numeric ideal of harmony still in force. The form of energy by which the planets are balanced in their courses is gravitation: its work can be accurately measured, but mechanical science is unable to determine what it is in itself. It is incessant and omnipresent. Like heat and light it may be termed one of the forms of Divine activity. It is the simplest of the forces of nature. No interval of time is required for the gravitating force that belongs to one body to reach another however distant. Sound does not pass through a vacuum, light is checked and heat is easily obstructed, but the force of gravitation admits of no suspension. Better than any other form of activity in the physical creation it represents the absolute unity and omnipresence of God.

In the solar system it stands in harmonious relation to another activity by which the planets are safely carried on their way. The nearer a planet is to the sun the swifter must be its motion. By diligent observation of their times and positions, the law of planetary adjustment has been discovered. It is this: — The square of the number of mean earth-solar-days in which a planet makes one revolution around the sun, divided by the cube of its mean solar distance in earth miles yields the same quotient whether the planet be more or less remote from the sun. It is Kepler's third law of motion $\frac{t^2}{d^3}$ equal to one million million millionth of .17456.

The speed of planetary motion ranges from 3 to 25 miles per second, the slowest being Neptune, the most remote from the sun, and the swiftest, Mercury. The place which a planet holds in this vast system of moving bodies is well expressed by the square root of its solar distance; for the gravitation that belongs to the sun decreases in proportion to the square of its distance from the planet. Now the space covered by the radius-vector in a given time, being the result of the balancing of the centripetal and centrifugal forces, is a constant quantity wherever a planet may be in its orbit. The radius-vector spaces for a given time determine most accurately the numerical relation which the several planets bear to one another. The given time then being one day of twenty-four hours, the spaces covered by the radius-vectors of the several planets are in the ratio of the square root of the solar distances; hence the relation which a planet bears to the solar system in its orbital motion is correctly expressed by the square root of its mean solar distance. In this way we find that the planets bear a remarkable rhythmic relation to one another. The square root of solar distances in miles, according to Lockyear, is as follows: —

Mercury	35,390,000 ;	square root =		5.95	thousand.
Venus	66,130,000 ;	"	"	8.1	"
Earth	91,430,000 ;	"	"	9.6	"
Mars	139,310,000 ;	"	"	11.8	"
Asteroids	250,000,000 ;	"	"	16.	"
Jupiter	475,690,000 ;	"	"	21.8	"
Saturn	872,130,000 ;	"	"	29.5	"
Uranus	1,753,850,000 ;	"	"	41.9	"
Neptune	2,746,210,000 ;	"	"	52.	"

Now comparing these square root numbers with the vibration numbers of the music scale by tenths, we have the following remarkably close coincidences:

Mercury.....	5.95 ;	C	2d	octave below.....	6.0
		D	"	" "	6.5
		E	"	" "	7.5
Venus.....	8.1 ;	F	"	" "	8.0
		G	"	" "	9.0
Earth	9.6 ;	G♯	"	" "	9.6
		A	"	" "	10.0
		B	"	" "	11.2
Mars	11.8 ;	C	1st	" "	12.0
		D	"	" "	13.5
		E	"	" "	15.9
Asteroids.....	16. ;	F	"	" "	16.0
		G	"	" "	18.0
		A	"	" "	20.0
Jupiter.....	21.8 ;	A♯	"	" "	21.3
		B	"	" "	22.5
		C	middle	.....	24.0
		D	"	.....	27.0
Saturn.....	29.5 ;	E	"	.....	30.0
		F	"	.....	32.0
		G	"	.....	36.0
Uranus.....	41.9 ;	A♯	"	.....	42.6
		B	"	.....	45.0
Neptune.....	52. ;	C♯	"	.....	51.2

Thus the earth and its celestial companions are set in numerical harmony like that displayed in notes, colors, molecules and crystals. The activities that determine the stability of our solar system truly present an ideal harmony that belongs to creation. The accomplished singer, according to the perfection of his musical nature, does his work easily without taking count of the number of vibrations necessary to produce each

note; so God's creative work in all its physical relations is the necessary product of His perfection. That work stands before us an accomplished fact, its laws are open to human investigation, and it is in them that we may discern the Divine ideals of harmony.

The earth holds a unique place in the solar system. Its orbit is not midway between Neptune and the sun, for Neptune is more than thirty times as far as the earth from the sun; but the force of gravity diminishes so rapidly that the sun's attraction of Neptune is only $\frac{1}{900}$ of its force on the earth. By the law of gravitation it is found that the circle of mean solar gravitation is nearly coincident with the earth's orbit, so we may say that this orbit is the balancing line of the solar system, — as G is close to the mean of the vibrations that comprise the musical octave. Perhaps this is why Kepler's third law is a music numbering only when its units of measure are earth days and earth miles. We cannot regard God's work as in any way accidental. The solar system is as it is because He designed it so to be; but why He has given the earth its unique place in that system we may let faith answer.

CHAPTER II.

IDEALS IN NATURE — PLANT LIFE.

THE primary ideal displayed in the production of plant organisms is companionship. I have shown that in the physical harmonies of Nature there is a persistent grouping of chords. Colors everywhere in nature stand in groups; so also do chemical elements; and most wonderful of all, the starry heavens are in vast groups called solar systems, every fixed star being the centre of worlds which move in close relation to one another. The universe is a creation of families. Isolation is repulsive to the whole order of Nature. Creation is born of the loving and loved companionship that belongs to God's own being, and is a revelation of the eternal harmony of Divine thought.

The ideal companionship displayed in the production and support of plant organisms reveals a progressive phase of Divine activity. In our handling of natural elements we fail to bring forth any form of plant life except on the basis of existing life: the living germ must precede the development. The life that makes the germ productive is beyond our power to analyze. We can say, *it is*, and we can trace its evolution in root, stem, branch, leaf, blossom and fruit, after its own kind, but we cannot grasp it; nevertheless by careful study we may investigate the processes of life-activity and discover the Divine ideal in which they rest.

In the lowest of plant forms, the algae, there is no reproduction without dual activity; the fertilizer and fertilized, male and female, giver and receiver, are necessary. The two modes of reproductive activity may exist together in a cell of protoplasm under the forms of nucleus and cytoplasm, but propagation takes place by a division in each, the separated parts uniting to make a new life-cell like the mother-cell; a joint activity is always necessary to reproduction. This duality of force is shown in the double extremity of a stem of algae; each of the two protuberances developing into a branch, which in its time matures in the production of another double extremity. It is one form of ideal sonship.

In the higher forms of plant life we find that a persistent duality is the basis of every new growth. The fertilizer and fertilized, however, are more distinctly and separately developed. In water plants the two float independently, and reproduction takes place only as they are brought together, when, by contact, the germ force of the one takes possession of the other. In flowering plants of the higher orders, pistils and stamens contain the two elements of fructification; thus companionship is the ideal basis of the whole body of plant organisms that enrich and beautify the earth.

Following the natural growth and spread of any form of plant life we find it most luxuriantly displayed in societies. The lichens, mosses, grasses, tubercles, vines, trees, grains and shrubs live in clustered dwelling places by themselves; and even when a field is occupied by

different genera there is a tendency in the stronger to displace the weaker. Natural law in the reproduction of plants seems to be averse to the mixing of genera. Each is kept within the limits prescribed for its life. Steadfast order is thus preserved and amalgamation of distinct genera is prohibited. Were it not for this limitation, all plant forms might eventually become merged into one monotonous growth with a loss of individuality and the power of reproduction. While therefore we recognize a fundamental unity in plant organism we must also recognize the ideal of elementary race-distinctions as the necessary basis of perpetual fruitfulness, — distinctions due to different kinds of life-activity.

Within each family every plant has its own individual life. The vine may cling to a tree for support, but its vine life is not the life of the tree: on a magnificent scale in the plant world does the ideal of individuality have free play. No two apples, flowers, fruits, or grass-blades are identical in form, color or texture, yet every one of its kind bears the family likeness. The law of the plant world is, that individuality of growth must not be destroyed by family absorption. These three ideals dominate the plant world and determine its companionship, viz: organic unity, family development, and individual integrity. It is an ideal harmony in which the splendor of Divine workmanship passes our comprehension. The door of the plant world opens into the presence of the loving Father of light. As we reverently observe His groupings and pencillings, we discern His ideal of a living fruitful fellowship in the form,

relation and numbers by which families and individuals live the life He gives them. The processes of nourishment, growth and structure, as well as of reproduction, are much the same as those which appertain to other living creatures; which shows that all living things have a common nesting place in a basic ideal.

Plant organisms may be classified as sea weeds, mosses, ferns, and seed or flowering plants. Within these great generic families there are many specific groupings. The algae or sea weed families are red, brown, green and blue-green. The blue-green algae appear in patches on rocks, walls and the trunks of trees. Propagation is by division of the protoplasm within a cell until its wall is broken, when a chain of cells begins to be developed. The green algae appear as a stain on the trunks of trees or a scum in fresh-water pools; reproduction is by cell division in the lower forms, but by egg fertilizing in the higher forms. The brown algae live in water and are distinguished by long thread or ribbon-like growths; reproduction is by the fusion of male and female cells of protoplasm. The red algae are mostly marine plants anchored by a root-like extremity and bearing filamentous branches beautifully tinted; the generative process always produces just four spores.

Mosses have a root, leafy body and a naked stem bearing a capsule of life. The generative force from below produces the leafy body, which develops the stem at whose extremity the generating life is veiled in a capsule. It is in the second or third generation, so to speak, that the vitality of moss-life becomes emin-

ently reproductive. Sperms and eggs are developed in the leafy body, but reproduction by fusion of sperms and eggs actually takes place in the capsule above; the product is a tetrad, a group of four spores. Mosses appear almost everywhere, but their fullest luxuriance is in moist or still-water places where they constitute the massy vegetation of bogs. In moss life the sperm force not only fertilizes the egg, but provides for it the nutrition necessary to growth and the reproductive function.

In fern life the leaf is the dormitory of cells. Each cell contains four apartments made by the intersection of two partition walls. From one springs the first leaf of the embryo plant; from another the nursing root which for a time connects the cell with the mother plant; from the third is developed the stem or trunk, and from the fourth the root of the future plant. This arrangement provides not only for a growth independent of the mother plant, but for the development of a living framework to support the expanding and delicate tissue of the leaf. This framework, the vascular system, branches out from a strong central axis with increasing minuteness and becomes the channel of nutrition between the leaf and the stem that reaches down to the soil. Reproduction, as in the mosses, is fourfold. The fern is more highly organized than the algae or mosses. In structural form it finely represents a building ideal; hence, to the duality ideal of algae life, and the triadic form of moss life we have here in ferns the tetradic feature of constructive work; each step in the record of plant development places the life processes upon a

higher level and displays a capacity for greater and finer work.

The family differentiation of plants briefly summarized may be stated thus: The algae have a body but no eggs. The mosses have eggs but no vascular system. The ferns have a vascular system but no seeds. The flowering plant has a seed on which reproduction depends.

The seed plant family is by far the largest and most conspicuous in the plant world. The seeds appear in two forms, naked and inclosed. The naked seed plants comprise but a small part of the seed family, but include the pine, spruce, hemlock, cedar and other evergreens. It is an ancient tree-group, with only about four hundred species now in existence, which live in societies as forests of pine, spruce, hemlock, etc. The seed is the matured product of germination, the fertilizing germ having entered and fused with the ovule which lies embedded in a special apartment called the ovary. The resulting new life-form is an embryo which becomes enclosed in a shell that is sometimes wrapped in a pulpy coating. The shell protects the seed life from injury, and it may be many years before the necessary conditions of warmth and moisture enable the embryo to be developed into an independent plant.

The other division of this family develops seeds in a seed vessel and contains about 100,000 species, including trees, shrubs, vines, herbs, etc., with terms of life ranging from a few days to centuries. The plants have true flowers, with pistils, stamens, and petals of most brilliant and varied colors. They are insect-loving, and

reproduction is by means of the insects that carry the pollen grains from plant to plant; hence frequently the offspring is the fruit of intermarriage between plants that are more or less closely related, and displays the individual feature of its double parentage. In the process of reproduction the fertilizer, or pollen grain, having been brought to the stigma or door of the ovary domicile, develops a pollen tube by which it enters the ovary apartment and takes possession of the ovule; the embryo sac becomes enclosed in a protecting shell and its occupant remains quiescent, awaiting the moisture and warmth necessary to its development into independent life.

A notable feature of seed plants is the provision for active commercial relations in the internal economy of plant life. This is effected by means of the vascular system, consisting of highways for the transportation of food and whatever is required for the individual life of the plant. By its agency injuries are repaired, wounds are healed, and the loss of moisture from the soil in time of drouth is made up by absorption in the great leaf surface upheld by the vascular system. It is altogether a beautiful exhibit of community of interests, so needful in human civilization. Thus in the highest order of plant life the ideal of living companionship is presented as the necessary basis of that which is most lovely and desirable among living creatures.

The ideal of companionship is again presented in the flowers of the seed plants. The lowest forms are spirally developed around an elongated axis, the branching however in some species being quite irregular. In

higher orders there is a cyclic grouping at intervals about the axis, analogous to a village community; while in the highest and most complex species the flowers are massed in a compact head which might be called a flower city.

The matured flowers of many seed plants present mathematical features with remarkable constancy. As we have already observed, reproduction involves dual action, which in numeral symbolism is represented by 2. The law of numbering is found in the petals and other organs of the flower. "In all the evolution from the spiral to the cyclic arrangement there is a constant tendency to settle down to certain definite numbers. In cyclic monocotyledons there are nearly always just three organs in each cycle, while in cyclic dicotyledons the number five prevails, but often four appears." In some species of these families the organs are in sets or multiples of 3, 4 or 5. The flowers "in fives" are greatly in the majority.

Most commonly grass flowers have three stamens, but the number ranges from one to six. The palm flower is quite definitely "in threes." The lily family has usually six stamens, three in a set, but in the water lily the number is very numerous. The mustard family, including cresses, radish, peppergrass, etc., has four sepals in two sets, four petals in one set, and six stamens. The rose family keeps most frequently to five sepals and five petals. Umbellifers have two carpels, but five sepals, five petals, and five stamens, the highest floral formula; it includes carrot, parsnip, fennel, coriander, celery, parsley, etc.

Sympetalous flowers, whose petals coalesce, are constantly cyclic "in fives" or "in fours." The "fives" appear with five sepals, five petals, five carpels, and two sets of five stamens. The higher groups of sympetalous flowers have five sepals, five petals, and five stamens, but only two carpels. The heath family is pentacyclic and includes huckleberry, cranberry, blueberry, bearberry, trailing arbutus, wintergreen, heather and mountain laurel. In the morning glory and its congeners, the gentians and dog-banes, the regular sympetalous flower reaches its highest expression in the form of tubes, funnels, trumpets, etc.; the flower is cyclic "in fours."

The greatest family of seed plants is the composites. It is more than one-tenth of all seed plants, and contains not less than 12,000 species. The flowers are massed in a compact head. It is the latest product of seed development and thus stands to the plant world as the city does to the world of human life. In this compact form of living companionship the individual organs of the flower are modified to suit their close environment, a necessity experienced and recognized in city life.

Whatever be the form or habitat of a plant development, it must have its time of rest. Some fold up themselves at sunset and sleep through the night; many lie dormant during the winter's cold, and all have their days of quiet between the fruit-bearing seasons. The ideal of rest appears to be an essential part of the concept of plant life, and limits are set for periodic activity. It is the rhythm of life.

The numerical feature of floral construction is so conspicuous and persistent that we are constrained to regard it as one of the many ways in which the Divine ideal of living companionship is expressed; hence in plant enumeration we see 2 as the symbol of reproduction, 3 as the symbol of organic unity, 4 as the symbol of structural composition, 5 as the mark of a highly organized activity, and 6 as the symbol of periodicity.

All this magnificent realization of an ideal springs from a life-fountain called protoplasm, whose chemical elements are hydrogen, oxygen, carbon and nitrogen. These pervade all parts of the plant world; the first three may be termed the light, the food, and the fuel of vegetation, while the last, nitrogen, serves as a disintegrant to prevent excessive crystallization, and to keep the living organism in a state of internal flux, a necessity for growth and reproduction in living things.

ANIMAL LIFE.

The characteristics of ideal companionship in plant life, involving reproduction, growth, organic structure and society relations, reappear in animal forms and habits, but with a positive difference which may be broadly defined as consciousness. This is the beginning of a new order of life. The old environment is made the habitat of a new impulse which develops and reproduces its like, yet preserving many characteristics of its parentage; hence, animal life is not altogether a new creation; it inherits the activities of a preceding life, which, in co-operation with the force of conscious-

ness, transfigure the inheritance and evolve a much loftier ideal of companionship.

The differential *motif* in animal life is shown in its structure. Here, as in the plant world, we have a body, limbs, skin, flesh, framework, circulation, breathing, digestion, waste, repair and co-ordinate activity; but through the increment of consciousness all these elements of companionship are lifted to a much higher plane. The laws of reproduction and growth, as marks of Divine activity, continue in force, but the results, in the form of legs, arms, wings, eyes, ears and mouth, are placed somewhat within the control of the conscious creature. Individual effort is thus made necessary to individual life. Hunger and passion are nature's spur to such effort. The animal consciousness lives a passionate life, a life of pain, joy, love, sorrow, fatigue and rest. It is an ideal of companionship that comprises a large part of the characteristics which belong to human life.

To realize such an ideal a form of organism different from that of the plant world is required. The consciousness that is to receive the touch of outside things and use its habitat in responsive action needs a secure throne room in which it can live and act; such a provision is made by the position and construction of the brain. Here lives the animal consciousness. To be in communication with the outside world its body is equipped with nerves ready, like a telegraphic system, to serve its will. The status of animal life may be defined as a creature that is sensitive, self-acting, purposeful, and within limitations vested with power to satisfy

its desires. In these conditions we have an individual development of character within an ideal companionship that involves freedom of action.

Very interesting phases of this development are displayed in animal habits. Society grouping is one of the most conspicuous; the animal hermit is even more rare than the man hermit. The predisposition to live together is quite as necessary to reproduction as it is to the development of character; hence universally we see individual lives grouped in pairs, families, flocks, herds, schools, or swarms. In some species of birds monogamy has a strong hold, not for a season only, but for life. Mating in the spring-time is an important affair, and depends upon individual loves; it is not a mere chance affiliation. Rival lovers strive by song and athletic exhibitions to win the love of the expectant bride; and sometimes the rivalry ends in a fight, and the victor flies aloft accompanied by his prize.

Polygamous habits are limited, so that only the eggs of hens in favor with the cock of the roost are fertile. Mammals show the same limitations of desire. Somehow free-love does not prosper under the ideal companionship in which animals have their being. The unlovable mating of birds, even when caged together a long time, is stoutly resisted. Love as the foundation of reproductive companionship is one of the strong characteristics of animal life. The male and female who dislike each other will not mate.

The physical difference between the sexes has attracted much attention. The male is armed for battle, and is much more energetic than the female. He hates

a rival in his love affairs, and is never at rest until he kills him or drives him out of his dominion. This excessive energy is constitutional, and, in connection with a predisposition to rule alone, may be regarded as a necessary provision for reproduction and the maintenance of race integrity. Sexual difference, including character, is prenatal in the protoplasmic beginning of individual life, and belongs to the mystery of reproduction. It forecasts for conscious life a companionship of individuals unlike by nature, yet in possession of a vast number of characteristics common to both sexes. Under these conditions it is easily seen that female beauty and loveliness, both in form and character, are great stimulants to male bravery and effort; while male bravery and effort are a great satisfaction and comfort to female reserve, endurance and suffering. These aspects of ideal companionship, so conspicuous in human life, belong to the various orders of animal life. The law of sexual differentiation is one law for all grades of animal existence.

Motherly love is almost universal. Birds do their brooding patiently, in expectation of the hatch, and generally sacrifice themselves for the sake of the little chicks. Mammals show the same affection for their offspring. To both sexes the breeding time is a day of loving sacrifice. Love is not confined to animals of the same species; the cat will warm motherless chicks; the dog will care for motherless kittens. Sympathy for those in distress is beautifully displayed in animals. Notwithstanding the fierce hostilities that sometimes rage among them, the spirit of love finds place for

expression. We need not say that this loving characteristic in animal life is the foundation of the attachment which grows up between a teamster and his horses, a hunter and his dogs, a woman and her pets. The Divine ideal to love and be loved, to live together in sweet accord, is realized, though differences be so great they cannot otherwise be bridged. Congeniality of love is what makes life great, noble, strong and beautiful to Him who gives it being.

Patriotism is a notable characteristic of animals, especially of such as live in droves, flocks or swarms. Bees unite in defence of their home. Ants wage fierce wars with invading ants. The stimulant to such action is not individual hatred but love of home.

Among individual characteristics we may note the spirit of investigation. The dog is stirred by an unusual sound or movement, and is not at rest until he has searched it out. The horse who is once frightened on passing a strange object continues to show his unrest until he is able to feel or observe it, and know whether it is harmful. The search for food in wild life is a constant exercise of the investigating faculty.

Perhaps the most wonderful characteristic of animal life is language. Pleasure, fear, love, hate, confidence, faith, distrust, etc., are positively expressed in the animal voice. The cock's crow, the hen's cluck or scream, the dog's bark and growl, or cry for help when lost, the horse's neigh, the cat's purr, the bee's hum so different in battle and work, and the bird's chirp or song, are intelligible notes of feeling and thought. The jay, by a

peculiar cry, gives to all within hearing his notice of an imminent danger; the hush that follows shows that the warning is understood. The mother hen has her food-call for the chicks scattered about, and her warning cry that quickly gathers them under her wings. Ants in battle move by companies and regiments in obedience to their leader's command. Written language, the language of visible signs, has place in animal life. The cow knows her own pasture, and detects the presence of a poisonous plant. The ox knows his crib and the way to the cooling waters. The hounds follow the foxy track. By the changes in nature's face animal travellers know when to go or come. Signs, open to watchful eyes or discerning nostrils, are to them as clock-dials or guide-boards along the way. No doubt they who live in pairs know each other's foot-prints. The language that is intelligible to animals is a marvellous record of life in a community of interests wonderfully like human habits and experiences.

It is needless to say, though it be only a matter of belief, that the wide range of thought and passion characteristic of animal life is involved in the primary divergence from a purely plant life. The process of development from the tadpole to the eagle and horse is not a display of chance happenings, like the throw of dice, but the exhibit of an intelligent purpose, the progressive and persistent working out or building up of a high ideal of companionship. To this end the actors in the great drama of animal life are qualified for their parts by a stable law of inspiration which we call animal instinct. To this is due the high degree of construc-

tive skill shown in the geometric accuracy of the spider's web and the honey bee's cell.

The status of the animal world, as an exhibit of Divine workmanship, may be summed up in these terms: — self-consciousness, reproductive activity, constructive ability, respect for natural law, periodicity in habits and movements, seasonable rest, and living relations in community life; all these elements in working order present an ideal of companionship very far above the plant world, though retaining many of its characteristics.

But could this ideal satisfy the supreme love, knowledge, power, and sovereignty of God? Do not the successive departures based on the introduction of new increments of activity foretell a further departure based on a much more exalted — even a godlike — increment of activity for the production of the human race? There certainly must be a basis for the vast difference between man and his animal progenitors. Without such an increment, it is impossible to find a rational accounting for the difference. All history shows that the characteristics of animal companionship are wonderfully magnified in human life. The scaleless, featherless, hairless body of man indicates a new order of life. Great as man's animal heritage is, physically, mentally, and passionately, a new increment of activity, involving infinite possibilities of development, differentiates him from all preceding forms of terrestrial life. The fact of such an increment is truly expressed in the word, "Let us make man in our image, after our likeness: and let them have dominion over . . . . all the

earth . . . . And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man *became a living soul.*"

From the facts of human life we can determine in part what is the Divine ideal of manhood. Among the characteristics of this ideal we may note, in addition to self-consciousness, reproductive activity, etc., that belong to animal life, the power to investigate, analyze and read the character of the activity displayed by the Divine Architect in His creative work. By this process our conception of the love and greatness of God is built up, enlarged and beautified from age to age, yet never completed, for it grows as we grow into the likeness of God.

In this vast and endless scheme of evolving greatness, language made perfect is of masterful service; so that each generation is a harvester of the past and a seeder for the future. With human elements at His disposal the Great Architect is raising up a marvellous fabric. He keeps human energy at His work and within the traces; and the struggle for something better, something greater, something higher, continues; and "It doth not yet appear what we shall be."

Astounding greatness was reached many centuries ago. Generations rose and fell, one after another, till the earth was strewn with relics of beauty and of splendid achievement. Prophetic visions were displayed to no effect. The world was mad for game. But the Holy Increment of life now enhoused in human flesh makes possible a true and full realization of the Divine ideal of manhood. The purpose and value of this

enrichment are partly seen in the product it yields for the beauty and glory of human effort inseparable from the loving companionship of God. The raven cries for food and eats what God provides. Under the supremacy of Divine love, the law of life and progress is, Work lovingly with God to build God's temple. Conscious co-operation with Divine sovereignty and love, — this is the ideal companionship forecast in the beginning, and set forward by successive increments of activity from the day when the earth was without form, and void; and darkness was upon the face of the deep.

THE HUMAN BODY.

The natural phenomena that we have thus far considered show ideal groupings that stand in harmonious relation to one another. Individual isolation appears to be no part of the creative purpose. The lowest form of grouping is seen in the sand of the sea shore; every grain is complete in itself, yet it is one of a group of grains, massed together without adherence. A higher form of grouping is found in water, where all units are in motion within a fixed law of relationship; analogous to this are the planetary movements of a solar system. Another form is seen in crystals and rocks stratified or conglomerate, where there is a fixed adherence of units in accord with a rigid law of association. A still higher ideal grouping is found in plant organism which combines unit movements with fixed relations, and secures an interchange of elements between root, stem, leaf, sap, flower, fruit and cells, which live together as a family of units controlled by what may be termed the

life-force. Next higher than this, is the grouping of similar activities in animal forms with the addition of consciousness, wherein the ideal of co-operative movements involving affection and intelligence is conspicuous. It borders closely upon human life, and often exhibits a fine appreciation of what is right or wrong in human conduct. In this grouping of conscious activities the Divine ideal of companionship reaches a high development.

Far above all these is the grouping that belongs to human life. The lower forms are retained, but in man the ideal of conscious co-operative activity with God is displayed; the creature comes to know that he has companionship with his Creator. Not every man duly recognizes this purposeful relation; nevertheless it is comprised in the Divine ideal of human life, a life of intentional and loving co-operation with God's modes and ways of action, whether these be manifested in physical phenomena or in the spiritual codes He has appointed to secure a loving partner in man.

Now the human body is so constructed that it can be used happily to this end. Through physical sensations we are in conscious touch with God's workmanship. By inspiration He enables us to interpret His work, to think along the line of His thought, and to perceive what He would have us do. Our body is the tool He has given us to help Him in the execution of His creative work. In the Divine economy of life, individual effort is required for our growth in power to perceive as well as to do our part. We take food and He builds it into bones, nerves, muscles, tissues, blood-corpuscles,

arteries, veins and cells, and sustains their functional purpose, keeping Himself in constant communication with us: so He lives in us and we in Him.

This ideal of a working companionship with God involves a transmutation into the likeness of God dependent upon individual effort. He sets us in the midst of His own activities, with the broad facts of nature open to our inspection, and inspires us to search the hidden things of earth and discover somewhat the intelligence, power and love that are veiled in material things. It is thus by effort that we grow into an appreciation of His workmanship. Here the factor of personality is of chief importance. It does not satisfy the purpose of our environment to search and trace one nerve activity from the finger tip to the brain, and another from the brain to the muscles of the arm; a twofold personal activity is present, — one, to preserve bodily functions in working order; the other, to use those functions intelligently with fixed purpose. The human personality and the Divine personality work together, and the result is definite action, it may be the lifting of a stone, or the delivery of a great speech. We can interpret the action, but we cannot, with a dissecting knife or the most delicate scales, reach either personality from which the action springs, or even know by analysis what it is; yet with equal positiveness we can think, "I am: God is." Unless the investigation of physical phenomena leads up to this postulate, with embracing love, it falls short of the purpose for which God has given us power to handle and search what He has put within our reach. Throughout such investigations

faith is an essential factor; faith in our sensations of touch and sight, faith in our intelligence and judgment, faith in the constancy of natural law. Logically the faith that is necessary for scientific work cannot stop short of faith in God. But faith is a personal function expressing itself in the formula, *I believe*, not my hand believes. The exclusion of faith from the Divine ideal of companionship is unthinkable. The ultimate problem in physical science is not merely to weigh and measure physical things, but to discover the rationale of God's activity. The functional purpose of the human body is to put our personality in touch with God's work; therefore it is an organism of exceeding delicacy, and wonderfully fitted to serve in a divine partnership. We are a part of the terrestrial whole. As the product of a long series of Divine activities we bear a likeness to the past, but with a differentiation that is well described in the Book of Beginnings as a likeness of God.

It is difficult to apprehend the full responsibility involved in such marvellous power to search and use Divine energy, or to forecast the result, but the personal activity of man in happy union with Divine energy evolves by historical stages a fruitage worthy of so vast and persistent an array of forces. Step by step, as this double handiwork advances in its fullness, we may look upon it and with our Most Holy Partner pronounce it very good, a temple of life whose light is the splendor of Truth.

Thus far I have endeavored to trace the Divine ideal of creative work in the natural order of things, and show that it comprises unity, reproduction, harmony,

construction, order, periodicity, rest, life, companionship and maturing completeness, which in numerical symbolism are represented by the cardinal numbers. I have endeavored to show that ideals expressed in numerical terms in the lower planes of physical phenomena become invested with loftier conceptions of the beauty and loveliness of God, as they reappear on the higher planes of conscious co-operation with Him; that what was begun and continued in Nature is wrought out more finely and enduringly in human life. Broadly speaking, these ideals are progressively exhibited: harmony of relations, living attachment and co-operative companionship. A reverent contemplation of these things may help us to read and understand what is written above and below, around and within.

CHAPTER III.

AN ANCIENT LANGUAGE.

ALL things speak to them who have ears to hear and eyes to see. Birds, beasts, flowers, trees, winds, and waves have a language which by look or action reveals the mystery of thought. The true observer reads the thought and finds within himself a responsive note. It is the rhythm of life, rhythm everywhere, in the winds and waves, in the sunlight, in the beating heart and the man's step. Its numberings are no less conspicuous than the ticks of a clock. Numeric language belongs to all human industries, and enters into all explorations in the realm of Nature. By Divine wisdom the clover lifts its three-leaved head, and the apple core holds its seeds in five cells. The numberings in Nature are revelations of the Divine ideal, and show some aspects of God's conception of harmony, life, unity, and completeness in creative work. The language of numbers is forever a living language.

Numerals are among the earliest forms of written language. Ancient peoples were passionate lovers of Nature: to them her dress was a Divine vestment; wind and rain were viewed as products of Divine activity. Days, moons, seasons and years were held in supreme reverence. The days were measured by hours, the moons by days, the seasons by moons, and years by

seasons, moons or days. It was a religious as well as a natural numbering, that grew into an ideal metrology touching all phases of human life. Thus in China the year-numbers 365 and 360 were the symbols of an unbroken series, like the undisturbed days of a ruler or years of a dynasty. The Hebrew records show that as early as 3000 B. C., 7 represented ideal satisfaction. In India the youth were taught to reverence the number 129,600 as comprising the whole compass of creation, and to give its numerous factors a due share of the honor. In the museum of the University of Pennsylvania there is a Babylonian tablet inscribed with some of these factors arranged in the following order:

2	5	720	1728
4	10	360	864
8	20	180	432
16	40	90	216
30	180	18	108
64	160	9	54

As a table of multiples and sub-multiples of 129,600 it is easily memorized. It is a table of time units and circular measure. The numbers were sacredly used in temple-building, as I shall show in the chapters on architecture.

Another school tablet in the same depository is inscribed with numbers that are wholly factors or multiples of 12,960,000. It is a series of problems in proportion in which 12,960,000 is uniformly the product of the extremes; IGI-GAL-BI means denominator.

TABLET.		A PROPOSED SOLUTION.	ANSWERS.
125	720		
IGI-GAL-BI	103680	720 : 103680 : : 125	: 18000
250	360		
IGI-GAL-BI	51840	360 : 51840 : : 250	: 36000
500	180		
IGI-GAL-BI	25920	180 : 25920 : : 500	: 72000
1000	90		
IGI-GAL-BI	12960	90 : 12960 : : 1000	: 144000
2000	18		
IGI-GAL-BI	6480	18 : 6480 : : 2000	: 720000
4000	9		
IGI-GAL-BI	3240	9 : 3240 : : 4000	: 1440000
8000	18		
IGI-GAL-BI	1620	18 : 1620 : : 8000	: 720000
16000	9		
IGI-GAL-BI	810	9 : 810 : : 16000	: 1440000

The division of the heavens in twelve signs belongs to this very ancient catalogue of symbolic numbers. Ideal numbering was spread wide over the earth. It was a recognized feature of all languages. Every Book of the Hebrew Scriptures bears witness to numeric symbolism. The custom of writing and speaking in this fashion continued to the beginning of the Christian era. It pervaded the religious philosophy of India and the idealism of the highest form of Greek thought. It is difficult to see how ancient writings of this class can be understood without knowing what ideals authors attached to their symbolic use of numbers.

The Jewish Encyclopedia speaks of the origin of numeric symbolisms as "lying in their connection with

primitive ideas about Nature and God; in later Jewish literature the symbolic use of numbers based on mathematical relations was introduced, due to the influence of Pythagorean doctrines; the rhetorical use of numbers is largely due to an obsolete symbolism."

As the Hebrew Scriptures are strongly marked by such use, the names of the cardinal numbers may be a clue to the ideals with which they were associated. Letters were used for numeric signs long before the alphabetic order was established, and it may be that the numeric value of the letters was the basis of the alphabetic arrangement. If this were the fact we might expect to find in the names of the Hebrew letters some root ideals corresponding to the root ideals of the names of the numerals, cardinal or ordinal.

ACHAD, 1. ALEPH, first letter.

Achad means one, unity absolute, and is only used in the singular. It is the root of *aluph*, the head of a family, a chief, a captain, hence the foremost or first of a group, be it a family, a tribe or a kingdom. Its fundamental idea is priority, prominence, supremacy.

SHENI, 2. BETH, second letter.

Sheni is from the verb *shanah*, to repeat a second time, to make a likeness. *Beth* signifies a house, a household, family descendants, offspring, race. The fundamental ideal in both names is reproduction: the son is a reproduction of his parents; plants are brought forth after their own kind.

SHALOSH, 3. GIMEL, third letter.

The numeric form of *Shalosh* is 3 . 3 . 3. It signifies a triad, a group of three, a third part. "The name *Gimel* differs only in form from *gamal*, camel, and its figure in Phenician inscriptions, ʌ, bears a certain resemblance to the camel's hump or neck;" but the Phenician letter ʌ more closely resembles the legs of a triangle, and since the form of nearly all Phenician letters involves an acute angle, we may perhaps be justified in assigning to it a geometric origin; in that case it would represent the two legs of a triangle, rather than a camel's hump.

The numeral 3 was held in great reverence by the ancient Greeks as the symbol of perfection. As we have shown in Chapter I, three is the numeric base of harmony in nature. The ancient idea of God was the all-embracing perfection. As the circle represents that which encompasses all things, so the triangle, the simplest form of an area, may comprise the perfection of nature. The strong chord of the natural gamut is a triad, the 1st, 3d and 5th. Any number that is a multiple of 3 will give a multiple of 3 in the sum of its digits. In view of the numeric relation which 3 holds to the forces of nature and the problems of arithmetic and geometry, it is easily seen how it may have come to be associated with ideal harmony and Divine perfection.

Its use in Hebrew literature is not a little remarkable. Numerous instances may be noted where it is directly connected with Divine action. The dreams of

the butler and the baker (three branches of ripe grapes and three white baskets of cake), interpreted by Joseph as three prophetic days of Divine appointment; Elijah's triple prayer with prostrations upon the dead body of the widow's son, followed by the return of life through God's act, and Daniel's kneeling three times a day in prayer to God for relief from the distress brought on by the king's command, show that the number three was closely and religiously associated with God in human affairs. It was accepted as a mark or sign of God's presence or purpose, like the sevens of Pharaoh's dream foretelling the years of abundance and famine. Esther's three days' fast for all the Jews of Shushan, as an appeal to God for protection against the wicked Haman, is evidence of faith in God. It was on the third day that Abraham saw the place where he was to meet God and make his sacrifice. Throughout the many centuries of Hebrew life it was the third time, the third day, or the third year that witnessed a revelation of God's presence in exalting His servant at the close of suffering or a trial of faith. As a symbol of that which is Divine three was pre-eminent among numbers, in the Hebrew mind.

ARBA, 4. DALETH, fourth letter.

Arba is derived from *reba*, four-square, *rabah*, to become much, or *arab*, to interlace as in lattice-work. Many English words are akin to it, as arbor, arris, arch, architect, etc. Its root ideal evidently is construction, up-building, as of a house, temple, altar. The ancient form of *Daleth* was a triangle, like the opening of a

tent-door. The name signifies a door or door-way. Now the door of a house represents the house itself, and also the household. An attack on the door is an attack upon the household. Houses and temples were constructed on a plan of four sides. The numbering of a people was by the measure of one side of a square, as "Who shall number the fourth part of Israel?" The earth is described by its four corners. The square as an area denotes a possession, a country, a dwelling-place. Creation is God's house. When the ideal square is built up in cubic form it becomes the symbol of containment; thus the Most Holy Place in the Hebrew Tabernacle and Temple was a perfect cube, the habitation of the Divine Presence. The fundamental ideal in the numeric symbolism of four is construction, be it of a temple, house, family, tribe or nation.

CHAMESH, 5. HE, fifth letter.

As a verb, *chamesh* signifies to be eager, excited, ready for action, prepared for battle. The warriors of Judah went up armed, that is, in groups of five. An army is comprised in five divisions, front, rear, wings and centre. The right hand of the magistrate, by its five fingers, represents his authority. Thus the number 5 becomes the symbol of sovereignty, law and order. The Hebrew decalogue is in two divisions of five laws each: the first appertains to laws of authority, the second to laws of social order. The fifth letter of the Hebrew alphabet signifies a window, the outlook for one who has the oversight and control of things.

SHESH, 6. VAV, sixth letter.

Shesh signifies something white, as the brightness of sunlight or of the stars, or of anything having a marble-like whiteness. It is the most conspicuous figure in the measurement of time or periodic movements. The circle has always been taken for time computations. Its divisions are multiples of 6. Months were reckoned 30 days; the year 12 months, 6 for summer and 6 for winter; the day 24 hours, the hour 60 minutes and the minute 60 seconds. Great importance was attached to the period of 600 years. In Japanese 6 stands for a day or any part of daylight. The letter *Vav* signifies a hook to hold curtains that admit or exclude the light. With such persistent association with the natural divisions of time it is difficult to see how people who were accustomed to observe the order of nature could fail to reckon six as the numeric symbol of time, day, periodicity, light.

SHEBAY, 7. ZAYIN, seventh letter.

Shebay means rest. Hebrew words of this form with a prefix or suffix almost invariably present the idea of rest or satisfaction. The industrial polity of the Hebrews provided rest for the land every seventh year, and after seven times seven years the great jubilee year began in which all debts were cancelled or satisfied, and all lands that had been leased were restored to their tribal occupancy. The Hebrew ritual was full of sevens to express forgiveness, peace, rest, or satisfaction. This use of seven was in force in the time of Christ, who said to Peter, Forgive seventy times seven,

—a forgiveness on both sides full and complete; that is, perfect reconciliation is to be established. In ancient Babylonia the 7th, 14th, 21st, and 28th days of the lunar month were legal days of rest. The name of the seventh letter in Hebrew signifies a weapon, or that with which a man might be satisfied for a wrong done against him. The mightiest weapon ever used for the suppression of wrong is forgiveness, the spirit of peace and good will.

SHEMONAH, 8. CHETH, eighth letter.

Shemonah is from *shamen*, fertility, fatness. All words beginning with *shem* denote a rising or falling, growth or decline. In the Hebrew calendar the eighth month was the fat month. On the eighth day after birth a son was circumcised to prolong and ensure life in his covenant relation. In Japanese 8 is the numeric symbol of a full stomach, or fullness of energy. The eighth letter in Hebrew is *Cheth*, from *chi* to live, *chath* alive, *chai* lively. Thus the ideal of life belongs to the letter whose value is 8, as it does to the Hebrew name of the numeral 8.

THSHAY, 9. TETH, ninth letter.

In Chaldee the gate of a city is *ThRAy*. The gate represents a corporate municipality or country, and stands for organic unity. In Hebrew the gate of the king is *ShAyR*, and like *ThRAy* in Chaldee, is not a private or common gate, but represents a corporate community. In Hebrew R is interchangeable with Sh; the substitution of Sh for R in *ThRAy*, the city gate, changes it to *ThShAy*, nine, but retaining the meaning

of *ThRAy* we have in nine the numeric symbol of organic unity, a community under one government, be it a family, a tribe, a city, a nation, or the whole body of God's household. The name of the ninth letter, *Teth*, is from *teth*, to collect, to gather, which accords with the numeric ideal of people collected together as a family, tribe or nation.

AYSER, 10. YODH, tenth letter.

Ayser signifies the conjunction of the ten fingers, things joined together, the whole, all a man has. Multiples of ten denote groups whole and complete, whether by hundreds or thousands. The name of the tenth letter, *Yodh*, is from *yad*, hand. In Japanese, 10 is the symbol of fullness.

For convenient reference we present the foregoing analysis in tabular form: —

LETTERS.		NUMERALS.	IDEALS.
א Aleph, joined.	A	1 Achad, unity.	Unity absolute, independent.
ב Beth, house.	B	2 Sheni, to repeat.	Reproduction, son, likeness.
ג Gimel.	G	3 Shalosh, triad.	Group, harmony, perfection.
ד Daleth, door.	D	4 Arba, four-square.	Building, construction.
ה He, window.	H	5 Chamesh, armed.	Law, order, sovereignty.
ו Vav, hook.	V	6 Shesh, white.	Light, day, splendor, time.
ז Zayin, weapon.	Z	7 Shebay, at rest.	Rest, forgiveness, sufficient.

ח Cheth, alive.	Ch	8	Shemonah, fertile.	Life, energy, abundance.
ט Teth, collect.	T	9	Thshay, gate.	Organic unity, family, nation.
י Yodh, hand.	I J	10	Ayser, all.	Completeness, fullness.

OTHER LETTERS WITH THEIR NUMERIC VALUES.

כ Kaph	K	20	ס Samekh	S	60	ק Qoph	Q	100
ל Lamedh	L	30	ע Ayin	Y	70	ר Resh	R	200
מ Mem	M	40	פ Pe	P	80	ש Shin	Sh	300
נ Nun	N	50	צ Tsadhe	Ts	90	ת Tav	Th	400

For the numerical representation of a letter its cardinal characteristic is used; thus *Tav*, 400, is represented by 4.

The ideals associated with the cardinal numerals are essential elements of human life, whether individual, family, tribal, municipal, national or religious. Translated in this fashion, the language of numbers attains great breadth and subtlety, and ideal metrology stands forth in the splendor of real life. It illumines the pages of Levitical law, reveals the glory of Divine appointments, and does for Hebrew literature what numerical analysis does for the Divine ideal of harmony in music, colors, molecules, crystal forms, plant organism, and the happy balancing of worlds in our solar system. Geometric lines and curves move in a spiritual atmosphere. Ezekiel's mystic city, by its symbolic measures, is revealed as God's country under the protection of the eternal J H V. All the numberings given for the measure of things appertaining to God's appointments for Israel partake of this spiritual metrology.

Thus numerical combinations, like word combinations, are a written language.

The elements of this very ancient language comprised in the symbolism of the numerals 1 to 10, reappear in the *Sefirot*, or Ten Perfections of Rabbinical literature. 1. Crown, inscrutable height, *i. e.* God; 2. Wisdom, *i. e.* begotten of God, *logos*; 3. Intelligence, intellect, *i. e.* harmony in thought; 4. Love, grace, *i. e.* spiritual force in social upbuilding; 5. Justice, power, *i. e.* administrative law, government; 6. Beauty, *i. e.* the splendor of spiritual light; 7. Firmness, *i. e.* moral and spiritual rest; 8. Splendor, *i. e.* life in action; 9. Foundation, *i. e.* family grouping; 10. Authority, *i. e.* what embraces all things, ideal completeness.

The Mosaic decalogue follows closely the same line of ideals: 1. God is first, above and before all; 2. Worship begotten of Him only is allowed; 3. Peace, harmony with God; 4. Sanctity of God's household; 5. Domestic order; 6. Forbids to cut short a man's days; 7. Forbids to destroy a man's peace; 8. Forbids to steal a man's living; 9. Forbids to destroy social harmony; 10. Concerns the fullness of ethical relations.

Likewise the eight steps of the *Yoga*, the best part of the Buddhistic philosophies of India, are akin to the ideals comprised in the eight cardinal numbers: 1. Observation, *i. e.* the beginning, or preparation for ascent; 2. Endeavoring, *i. e.* effort, a reproduction of what has been observed; 3. Position, *i. e.* right relation, harmony with Nature; 4. Detention, *i. e.* the preservation in stable form of what has been learned; 5. Results of detention, *i. e.* civil life, good order in public affairs;

6. Retention, *i. e.* making goodness a part of one's self; 7. Meditation, *i. e.* the soul's retirement and restful contemplation of the life of Nature; 8. Absorption, *i. e.* lost to one's self in the fruition of Divine companionship. These eight steps were symbolized in the architectural forms of the temples of India. In ancient oriental civilizations religious formularies rested upon dominant ideals of Nature and of life relations which were the basis of religious philosophies. Numeric symbolism was the veiling of truths held in supreme reverence by the Wise Men of the East, whose loving pupils caught their inspiration and entered into the life of their masters.

I give a few illustrations taken from ancient laws and usages. In reading his Bible, the reverent Hebrew priest does not pronounce the written name J H V H, but substitutes A D O N I. The numeric form of J H V H is 10 5 6 5, but sometimes the name is J H V, 10 5 6. The numeric form of A D O N I is 1 4 6 5 10, a compound of A D, strong, and O N I, 6 5 10, or numerically J H V reversed, and signifies the strong J H V, The Lord. The numeral for N is 50, or its cardinal characteristic 5, the same as H.

The name Q U B A L H, *cabbalah*, is a compound of Q U B and A L H. The cardinal form of A L H (God) is 1 3 5, and the cardinal form of Q U B is 1 6 2, which is also the cardinal form of A U R, 1 6 2, Light. Thus by numeric symbolism, Q U B A L H is Light of God.

The name J H V H is from the verb to be, H V H, 5 6 5, and when joined to 5, the numeric symbol of sovereignty, we have 5 × 5.65, equal to 28.25, the digit

measure of the cubit; hence the cubit is a symbol of the sovereignty, 5, of God, H V H. This is the rod by which Ezekiel's city of God and all the Divine appointments for the Hebrew tabernacle and temple were measured.

In St. John's vision a spiritual ideal belongs to the measure of the city, 144 cubits, which is the numeric form of A D M, 1 4 4, Adam, "the measure of a man that is of the angel." The mystic number 666 is also called the number of a man, that is, of the angel. These two numbers 144 and 666 have a unique relation, for 6 × 6 × 6 multiplied by .666 equals 144; hence both numbers are man numbers. For its application to the beast see Chapter XII.

The draught of fishes, after the resurrection of Christ, was numbered, and the number was 153, yet the net was not broken. This has been taken to signify the salvation of God's people; but we may observe that the letters represented by 1 5 3 are Q H L, *quohal*, which means all the assembly, all Israel. St. John numbers all Israel by another symbol, 1000 times 144. The number 1000 is the symbol of complete containment, being the cube of 10, completeness, and 12 times 12 represents the twelve tribes.

The closing verses of the Song of Solomon represent the Lord's share of the fruits of the vineyard as 1000, that is the tithe of 10,000. The keepers of the vineyard receive 200; the remainder left for the husbandmen is 8800. The keepers being the priesthood are given a small allowance, 200, equal to 5 × 40, that is a life of discipline, 40, is appointed, 5, them, but 8800

divided among the eleven tribes gives each 800, that is 100 times 8, abundant, 10 × 10, life, 8.

The measure of oil for the consecration of the High Priest was one log, and the molten sea of Solomon's temple held 144,000 logs, the numeric symbol of all Israel, a holy people.

The handwriting on the wall at Belshazzar's feast, according to numeric symbolism, admits of the following interpretation:

M N A, 4 + 5 + 1 = 10, completed, finished.
M N A, 4 + 5 + 1 = 10, " "
Th Q L, 413, for Sh Q L, weight.
P R S, 82.6 = 413 divided by 5.

M N A is not elsewhere found in the Hebrew Scriptures; it appears to be a word coined for this special purpose. Th Q L is a substitute for Sh Q L, *shekel*, which means weight, Th being interchanged for Sh. The numeric form of Th Q L, 413, divided by 5, the symbol of authority, gives the numeric form of P R S, 82.6. This symbolic interpretation agrees with that given by Daniel. (Dan. v: 26, 28.)

The numbers 1290 and 1335 in Dan. xii: 11, 12, may be written 1000, complete; 200, or 5 × 40, appointed discipline; 90, or 10 × 9, all the people; thus 1290 would signify that a cycle of suffering or discipline was appointed for all the people. The other number is 1000, fulfilled; 300 or 5 × 6 × 10, the full, 10, time, 6, is appointed, 5; 35 or 5 × 7, rest or peace, 7; appointed, 5; thus 1335 would signify that the appointed rest shall be complete in the full time appointed; the whole

then means that the day of rest shall follow the day of suffering, in God's appointed time.

The floor plan of Noah's ark, built by Divine inspiration, comprised six fifty-cubit squares, each square being equal to the area of the circle whose diameter is 56.5 cubits, the symbol of God's sovereignty. The height of the ark, 30 cubits, or 3 times 10, bears the numeric symbolism of sons, 2, in harmony, 3, with God, 5 6 5, for 10 is the side of a square whose area equals a circle of 2 times 5.65 diameter. We cannot say that God's use of numbers is fortuitous, or meaningless. What ideals are thereby expressed is a legitimate subject of inquiry. It is evident that a vast literature could be created in numeric form if cardinal numbers were recognized as symbols of ideals comprehensive, ethical and spiritual. Herein then may lie hidden the secret thought of ancient philosophers, architects, legislators and historians.

Poetic literature did not escape the fascination of numeric symbolism and harmony. "The days of our years are three-score and ten" was the Hebrew ideal of complete satisfaction, 10 times 7. The great Italian poet could give his Beatrice no loftier title than the ideal "nine, the similitude of her own self," for in his mind 3 was the symbol of Divine perfection, and 3 times 3 the embodiment of that perfection in the ideal sanctity of human companionship.

CHAPTER IV.

NUMERIC GEOMETRY.

In ancient metrology numerical and geometric symbols were closely allied. The year cycle was identified with the number 365, the circle with its numberings 360°, 21600′, 1296000″, and the four quadrants of 90° each. Another division held in great reverence was the pentagon, which might justly be called the star of ancient metrology.

Fig. 1.

Each division contains 72° or 4320′. One of the five parts, 72 units, being taken as the diameter of a circle, the circumference is integrally 226, or four times 56.5, and symbolizes house, 4, of God, 56.5, which agrees with the symbolism of 4320, the number of minutes in 72°, that is, consecrated, or what is holy unto God.

The circle whose diameter is 72 has the area 4068, equal to 6 × 12 × 56.5, that is, the day, 6, of the covenant, 12, of God, 56.5.

The religious use of the pentagonal circle in the Greek and Roman churches is well known. The common rosary is a circlet of beads in five sections attached to a cross. Each section contains ten beads, a large bead and nine small ones. The large bead is a symbol of the Lord's Prayer, and is called "Our Father"; the next three are "Aves"; the fifth is a "Meditation"; the next three are "Aves"; the ninth is a "Prayer"; the tenth is "Gloria Patri." The five sections are alike in form, but each has its own "subject." The first section is the "Incarnation"; the second is "Redemption"; the third is the "Resurrection"; the fourth is "Judgment"; the fifth is "Heaven"; the whole is designed to help devotion, keep the mind from wandering, train the religious motions of the soul in accord with the life of Jesus, and preserve the fundamentals of the Christian faith. It may be that no man is sure what was the real origin of this combination of beads in a circle of five divisions attached to a cross, but it is quite certain that a mystical use of the circle with the pentagonal star and the numbers associated with it reaches beyond the records of history. As a religious symbol of consecrated life the rosary is but one of many fruits of a holy ideal by which the Father of all souls reveals His presence, whatever be the form or color of the mantle that protects their faith in Him.

The Buddhist priest of India sees the likeness of life in Nature's motions. He takes a slender reed, goes

down into the river, sets it in the bed below, and reverently watches its movement, ceaseless and rhythmical, in the flowing water. He does not worship the reed, but swaying his body with its motions and saying his prayer, he puts his soul in line with Divine activity as it is manifested in the reed, to keep his mind from wandering, and sincerely renders his service pure and simple. It is one of many forms of spiritual drill. In some way, — we may not know how or at what time it was first spoken, — the exalted life of the disciple of Buddha was called a cycle of 4320 million years; that is, by numeric symbolism, a cycle or life of full and complete consecration. There were three of these cycles corresponding numerically to the three arcs of an equilateral triangle inscribed in a circle, each arc being one-third of 1296000 = 432000, which, taken 10000 times, gives the number 4320 million, 10000 being 10 times the cube of 10, that is, full and perfect containment.

According to the famous Rabbi Maimonides, the measure of oil prescribed for the consecration of the High Priest was 43.2 cubic digits, that is, one log, or about half a pint. The measure of the ephah in the Hebrew system was 72 logs, and a tithe of the ephah was the holy portion of the fruits of the soil reserved for the Lord's house. The log contained 4224 grains of pure water at blood-heat, or 4 times 1056, and thus represented the house, 4, of J H V, 1056. These correlations rationally belong to a system of numbering in which numerical symbolism was held in great reverence. (See Figure 6, below.)

A notable use of the pentagon for numeric symbolism in connection with other geometric forms is given in Plato's *Republic* (Book VIII: 546, B), where he compares the cycles of human imperfection to the cycles of Divine perfection, and says:

Ἔστι δὲ θείῳ μὲν γεννητῷ περίοδος ἣν ἀριθμὸς περιλαμβάνει τέλειος, ἀνθρωπείῳ δὲ ἐν ᾧ πρώτῳ αὐξήσεις δυνάμεναί τε καὶ δυναστευόμεναι τρεις ἀποστάσεις, τέτταρας δὲ ὅρους λαβοῦσαι ὁμοιούντων τε καὶ ἀνομοιούντων καὶ αὐξόντων καὶ φθινόντων, πάντα προσήγορα καὶ ῥητὰ πρὸς ἄλληλα ἀπέφηναν· ὧν ἐπίτριτος πυθμὴν πεμπάδι συζυγεὶς δύο ἁρμονίας παρέχεται τρὶς αὐξηθείς, τὴν μὲν ἴσην ἰσάκις, ἑκατὸν τοσαυτάκις, τὴν δὲ ἰσομήκη μὲν τῇ, προμήκη δέ, ἑκατὸν μὲν ἀριθμῶν ἀπὸ διαμέτρων ῥητῶν πεμπάδος, δεομένων ἑνὸς ἑκάστων, ἀρρήτων δὲ δυεῖν, ἑκατὸν δὲ κύβων τριάδος. ξύμπας δὲ οὗτος ἀριθμὸς γεωμετρικός, τοιούτου κύριος, ἀμεινόνων τε καὶ χειρόνων γενέσεων.

This may be translated as follows: —

"While on the one hand there is to a divinely begotten [*product*] a cycle which a perfect-and-complete numbering comprises, on the other hand there is to a human product (*a cycle*), in which, primarily, growths [*developments*] endowed with power and also having mastered three defections and taken on four combinations of [*things*] concordant and discordant, both increasing and decreasing, show all things to be mutually correspondent and rational: of which, a sesquitertial base united to a pentad, and increased threefold, affords two harmonies, the one, equal in every way (*a cube*), taken 100 times; the other, equal in length to the same but

oblong, and of 100 rational diameters of a pentagon, each wanting one [*dimension*], and both incommensurable, but [*a measure*] of 100 cubes of a triad. This entire geometric numbering, having masterly influence, is concerned with better and worse generations [*products*]."

This passage has been a great puzzle. The following solution rests upon the symbolic use of numbers.

The Greeks held the number three in great reverence as a symbol of Divine perfection, and here it is a factor of the Divine cycle of supremacy and government. In Plato's ideal the human cycle of government begins with a timocracy of primitive landholders, which is superseded by an oligarchy, and this in time yields to a protesting democracy, which becomes the hot-bed of despotism. Here are four strong powers successively enforcing obedience, and there are three revolutions or "defections," in national government. When all these have had their day the ideal Republic is to arise and make all things harmonious and rational.

"A sesquitertial base" is a base increased one-third; a tertial base being 3, its sesquitertial is 3 + one-third of 3 = 4; 4 "united to a pentad," 5, gives 9; which "increased threefold" is 27, the cube of 3, an "equal in every way" of the triad. This, "taken 100 times," is 2700, or one hundred cubes of 3, and forms a solid square, each side comprising ten cubes of 3, and therefore containing $10 \times 27 = 270$ cubic units. This square is the first of the "two harmonies," and represents the perfection of the Divine cycle, the cube of 3 symbolizing the containment of perfection, 3, and 100 its fullness or completeness.

The second harmony is a geometric *oblong*, "equal in length" to the square, 10 times 3; but it consists of squares of 3 instead of cubes of 3. The square of 3 is 9, equal to 4 + 5, that is, the sesquitertial base conjoined to a pentad; but since the length of the oblong is 30, one row of 10 squares of 3 contains 90 unit squares, which, "increased threefold," gives the number 270; therefore the oblong area that represents human imperfection bears a numerical likeness to the solid square of Divine perfection.

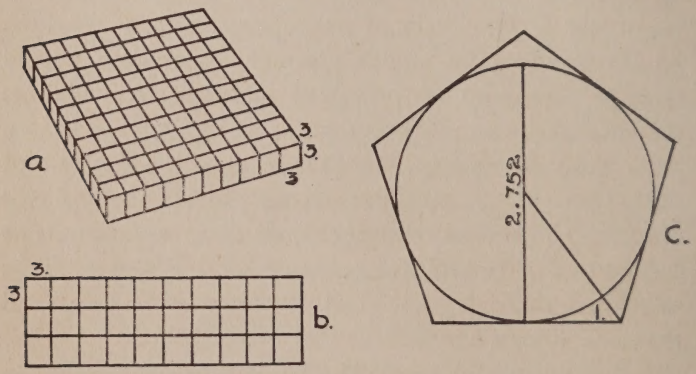


Fig. 2. *a*, 100 cubes of the triad. *b*, the oblong. *c*, the pentagon.

So far solid and square measures are used in the illustration. Next comes lineal measure; it is in the "hundred rational diameters of a pentagon." The tangent of a pentagon is the tangent of 36°; if this tangent be 1, the side of the pentagon is 2, and the diameter of its inscribed circle is 2.752, and 100 diameters = 275.2 = $10\frac{1}{5}$ times 27. Omitting the fraction $\frac{1}{5}$, to make the reckoning in "rational diameters," we have the number

10 times 27 = 270, which agrees numerically with the cubic measure of a side of the solid square containing 100 cubes of the triad 3. Thus the human cycle is described as having a certain likeness to the Divine cycle, though not identical with it, for as surface measure is not composed of lineal units, the oblong and pentagon are "both incommensurable." The solid square of 100 cubes of 3 is not composed either of lineal units or square units; the lineal measure of the pentagon is wanting in one dimension as compared to the oblong, and the oblong is wanting in one dimension as compared to the solid square. All three geometric forms, however, afford the number 270.

A favorite number in Plato's mystic symbolism is 1296000, equal to 2700 × 480. The latter factor, 480, is the octave of middle C, or 2 times 240; hence numerically 1296000 is a symbol of the likeness, 2, of the harmony, 240, of Divine perfection, 2700. Another measure of the circle is 21600 = 8 × 2700, that is the life, 8, of the cycle of Divine perfection, 100 cubes of 3.

Plato's forceful conclusion that, "this entire geometric numbering having masterly influence is concerned with better and worse products," may well command the thoughtful consideration of all legislative bodies. Human cycles of development cannot be divorced from the Divine cycles. To realize an ideal government in the overthrow of a despotism that rises out of a degenerate democracy, the Divine cycle of activity must become a controlling ideal, recognized and welcomed by intelligent rulers and legislators.

The worse or better in national life is but the larger development of the worse or better in individual experience.

The mystic number 1296000, involved in Plato's reckoning, was well understood many centuries before Plato's time. It was the numeric basis of astronomical measurements as far back as the records of history are traceable. It has never had a successful competitor in circular measure. Tablets of the fourth millennium B. C. are full of it. Its symbolic ideal was a fundamental element in the religion of the most ancient civilizations. There is no record of its primary adoption. Whence came it? Who devised it? Who was its fountain? Let faith answer. Somehow it is wonderfully fitted to measure the perfection of God's workmanship, and it does not appear that human ingenuity can produce an adequate substitute.

The number 1296 is 36 × 36. The circumference of the circle whose radius is 36, is integrally 226, that is, 4 times 56.5. The diameter of a circle being 226, the square of equal area is 200; if the diameter be 16 feet the error is only $\frac{1}{1000}$ of an inch. Thus by the numbers 36 and 56.5 the integral conversion of circles into squares of equal perimeter or equal area is accomplished without fractions, and with sufficient accuracy for practical purposes.

The right-angled triangle whose sides are 3, 4, 5, may be termed a fountain of symbolism in numeric geometry, on account of its unique relation to the entire system of ancient numeric symbolism. From the tertial root 3, harmony, we have the sesquitertial base 4,

building, — 3 + $\frac{1}{3}$ of 3 = 4 — which united to 5, sovereignty, gives 9, brotherhood, and 9 thrice increased gives 27, the cube of 3, the containment of harmony. Plato's square of perfection is 100 cubes of 3, or 2700, and 480 times 2700 equals 1296000, the ancient numeric symbol of that which encompasses the universe.

The sum of the squares of 3, 4, and 5 is 50, which is the side of a square equal to the area of a circle whose diameter is 56.5, a number that belongs to all forms of Hebrew architecture.

As early as 1700 B. C. the Egyptians were versed in arithmetic, algebra and geometry. The school book of Ahmes shows examples in fractions: $\frac{2}{37} = \frac{1}{24} + \frac{1}{111} + \frac{1}{296}$ being one of the simplest. The following problem is given: "Divide 10 measures of corn among 10 persons so that the difference between each person's share and the next is $\frac{1}{8}$ of a measure." It also contains many problems in plain and solid geometry, showing how to obtain the area of a square, oblong, isosceles triangle, trapezium, etc., and how, by trigonometry, to find the height of an inaccesible object, as the top of a tree. Decimal notation was known, and large numbers were handled with ease.

The application of these numbers in ancient architecture will be shown in another chapter.

CHAPTER V.

IDEAL UNITS. THE CUBIT.

In the Egyptian department of the Museum of Fine Arts, Boston, there is a scribe's palette, received from Memphis and believed to be four thousand years old. It is a rare antique of great metrological value. It is of wood, fifteen inches in length, an inch and a half wide and three-fourths of an inch thick. The right-

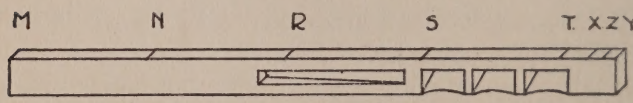


FIG. 3. THE SCRIBE'S PALETTE.

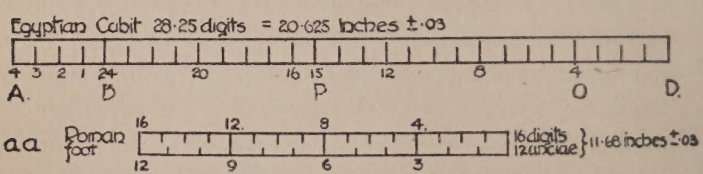

Egyptian Cubit 28·25 digits = 20·625 inches ±·03
4 3 2 1 24 20 16 15 12 8 4
A. B P O D.
aa Roman foot
16 12 8 4
12 9 6 3
16 digits
12 unciae
11·66 inches ±·03

FIG. 4. EGYPTIAN CUBIT AND ROMAN FOOT.

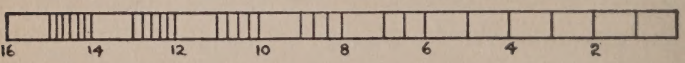


FIG. 5. THE DIORITE RULE OF THE STATUE OF GUDEA, ABOUT 3000, B. C.

hand end has three cups incised on the broad face, to hold colors for the artist's use; the edges of the cups show much wear by the brush. In the middle of the stick there is a deep undercut for brushes. On the narrow side six transverse lines are scored at irregular intervals, which mark important sections of the ancient Egyptian cubit.

M N + 4 S X = A D = The Cubit, 20.625 in. = 28.25 digits.
M N = A B = The Handbreadth, 3.1 in. = 4.25 "
M R = B P = Diameter of cubit circle = 9.00 "
M R + S X = P D = The Span, 10.95 in. = 15.00 "
4 S X = B D = Digit rule 17.52 in. = 24.00 "
T Y = ½ O D = ½ Palm 1.46 in. = 2.00 "
R Z = 11.27 dig., diag. of square of = area to circle of 9 dig. diam.
S X + 2 T Y = 10 dig., diag. of square of equal perimeter to circle of 9 dig. dia.

This cubit rod played an important part in ancient Egyptian architecture. Its total length in English inches was 20.625. Mr. Petrie, in *Pyramids of Gizeh*, confirms this measure as the result of his examination of many monuments and cubit rods. He says: "On the whole we may take 20.62 ± .01 as the original value; the digit (a subdivision of the cubit) is .727 ± .002; in some Egyptian cubits a decimal division is found as in other countries; the cubit and the digit have no integral relation, the connection of 28 digits with the cubit being certainly inexact." (Page 181.) This is the testimony of an expert whose experience and accuracy command the highest respect.

In the ancient treatment of geometric forms the conversion of a circle into a square of equal area, or of equal perimeter, was accomplished with remarkable accuracy: this could not have been done without a unit of measure. The peculiar division of the cubit in two unequal parts served this purpose. The right-hand division, 17.52 inches, comprised 24 digits; the left-hand, 3.1 inches, had four subdivisions with a total length of 4.25 digits; hence the whole cubit was 28.25 digits, equal to 20.625 inches; this gave .73 inch for the length of

a digit. Mr. Petrie gives .727 ± .002 as the result of his measurement of many cubit rods. The ancient Roman cubitus was 17.52 and its digitus was .73. The Egyptian cubit of the Turin Museum is 20.611 inches, that of the Louvre is 20.595; in both of these the left-hand division of four parts is greater than four digits of the right-hand division. It is therefore an error to reckon the whole cubit at 28 digits. It has 28 subdivisions, but its length is more than 28 digits.

No doubt the singular left-hand appendage of four subdivisions served some purpose in Egyptian metrology. What was that? Three of its subdivisions had a total length of 3.1875 digits; adding to this 19 digits of the right-hand part of the cubit, we have 22.1875 digits, which is the side of a square whose perimeter is equal to the circumference of the circle described on a diameter of one cubit, 28.25 digits. This geometric device gives the value of *Pi*, correctly to six decimal places, 3.141592 +.

Again, the circumference of a circle being 28.25 digits, its area is equal to the square whose diagonal is 11.27 digits, or closely approximate to 4.25 + 7 = 11.25 digits.

Again, at the 15th digit on the cubic rod there is a line scored across its face; the remaining 9 of the 24 digits is the diameter of the circle whose circumference is one cubit, 28.25 digits. All of these geometric coincidences are integrally correct. The problem of squaring the circle appears to have been practically solved more than four thousand years ago. From these observations the geometric purpose of the short appendage at the left hand of the cubit is evident.

HEBREW CIRCULAR AND TIME MEASURES.

A circle, 12 signs = 360° = 21600′ = 1296000″. A day is 24 hours. An hour is 60 minutes. A week is seven days. A month is 30 days. A year is 12 months or 360 days, also 365 days. A lunar month is 29.5 days. The seventh year was a Sabbatical year. The fiftieth year was the Jubilee year.

In symbolic usage a day represented a year. The year began about the time of the vernal equinox, and its passing was noted by a monthly numbering, as well as by the names of the months; the hours of the day, beginning at sunrise, were in like manner numbered. Other notes of time were also in use.

Another interesting feature of the cubit is its relation to the measures of time. The motion of the stars is reckoned by degrees, minutes and seconds, a circle being 360° = 21600′ = 1296000″. The circle whose circumference is 1296000 units has a radius of 206264; one ten-thousandth of this radius is 20.6264, which is numerically almost identical with the inch measure of the cubit 20.625.

The equinoctial year was reckoned 365 days integrally. The hundredth part of 3 times 365 is 10.95, which is the number of inches in the 15 digit section of the cubit, and represents the equinoctial year.

Again, Memphis was the ancient seat of Egyptian wisdom. A parallel of latitude passing through the northern precincts of that city is 21600 English miles, and 10″ of that parallel is 512 cubits, equal to 10560 inches; now the length of a pendulum beating seconds

on this parallel being multiplied by 1.056 gives the double cubit 41.25 inches, equal to 56.5 digits, a number closely allied to the specific gravity of the earth 5.65 ± .03.

Once more, the mean daily motion of the sun from the summer solstice to the autumnal equinox, measured on a meridian line, is 100,000 digits. These close relations between the cubit and the earth's dimensions, form and motions, give it a firm geodetic as well as geometric value.

The short cubit (24 digits) of the Egyptian rule was divisible by its units into halves, thirds, quarters, sixths, eighths and twelfths, a quality universally admitted as desirable for a measure in common use.

Ezekiel calls the short left-hand division of the cubit "a handbreadth," which is somewhat longer than the palm of four digits. The fifteen digit measure, equal to 10.95 inches, is the Hebrew span.

The cubit held a prominent place in Hebrew metrology. It was the basis of a system of weights and measures unsurpassed in the extent and harmony of its correlations. Temples and altars were measured by the cubit unit. The oil and flour for religious uses were measured by the log, which was 43.2 cubic digits according to the famous Rabbi Maimonides, that is, one-third of 129.6, the circumference by inches of the circle whose radius is one cubit, 20.625 inches, or 28.25 digits.

The religious tenacity of the Hebrew people served to protect the integrity of their metrology. Cubit, span, handbreadth, digit, log, quab, omer, hin, seah,

bath, and cor were not forgotten in their broken civilization. These measures were so identified with their religious obligations that such a misfortune was well nigh impossible. Commercial relations led to the introduction of their metrology to European nations. The 24 digit rule of 17.52 inches reappears in the Russian verschok 1.75 inches. One-tenth of the Hebrew reed of 6 cubits, 123.75 inches, is seen in the foot rules of Denmark 12.36, Norway 12.35, and Prussia 12.36. A dozen cubit rules appear of about 18 inches, probably derived from the 24 digit rule of 17.52 inches, or from the measure of six handbreadths of 3.1 inches. The Greek foot, 12.13, is one-sixth of 100 digits of .728 inch. The Roman foot, 11.65, is 16 digits of .728 inch. Austria's foot rule, 12.44, appears to be four handbreadths of 3.1 inches. Thus there seems to be good foundation for believing that the old European systems of metrology were derived from the cubit of Egypt, which was the cubit of Noah, Moses, and Ezekiel.

The following comparative table of weights and measures will enable the reader to see how closely the old European metrologies were in agreement with the factors or multiples of Hebrew measures. Nearly all foot-rules were divided into 12 aliquot parts. Division into thirds, fourths, sixths, eighths and sixteenths was also in use. The Hebrew log, 43.2 cubic digits, held 4224 grains of pure water at blood heat. Failure to observe the difference between the handbreadth, 4.25 digits, and the palm, 4 digits, has caused much confusion among some writers who have endeavored to determine the exact length of the ideal cubit.

COMPARATIVE TABLE, EUROPEAN SYSTEMS.

COUNTRY	UNITS.	LENGTH INCHES.	UNITS.	VOLUME INCHES.	WEIGHTS.	GRAINS.
Russia	Verschok	1.75	Tschaler	8.52	Fund	6318.00
Heb.	$\frac{1}{10}$ Sec. Cubit	1.75	$\frac{1}{2}$ log	8.40	$\frac{1}{2}$ maneh	6480.00
Milan	Foot	13.48	Pinte	61.30	Libra	15432.00
Heb.	18 digits	13.14	$\frac{1}{2}$ omer	60.10	120 shekels	15552.00
Portugal	Foot	13.33	Almada	1009.50	Fund	7083.00
Heb.	18 digits	13.14	5 hins	1008.00	54 shekels	6998.00
Austria	Foot	12.44	Mass	86.30	Mark	4336.00
Heb.	4 handbreadths	12.40	5 logs	84.00	$\frac{1}{3}$ maneh	4320.00
Berlin	Foot	12.36			Pfund	2177.00
Heb.	$\frac{1}{10}$ reed	12.37			$\frac{1}{6}$ maneh	2160.00
Denmark	Foot	12.36	Pot	58.90	Pfund	7720.00
Heb.	$\frac{1}{10}$ reed	12.37	$\frac{1}{2}$ omer	60.10	60 shekels	7776.00
Norway	Foot	12.35	Kanna	1276.50	Mark	3285.00
Heb.	$\frac{1}{10}$ reed	12.37	19 quabs	1277.00	$\frac{1}{4}$ maneh	3240.00
Prussia	Foot	12.36	Eimer	4192.00	Pfund	7216.00
Heb.	$\frac{1}{10}$ reed	12.37	250 logs	4200.00	$\frac{1}{180}$ talent	7200.00
Antwerp	Foot	12.13	Stoop	168.00		973.00
Heb.	$\frac{1}{6}$ of 100 digits	12.13	10 logs	168.00	150 gerahs	972.00
Anc. Greece	Foot	12.12	Kotula	16.47	Drachm	67.30
Heb.	$\frac{1}{6}$ of 100 digits	12.13	1 log	16.82	10 gerahs	64.80

Anc. Rome	Foot	11.65	Hemina	16.47	Uncia	420.90
Heb.	4 palms	11.65	1 log	16.82	$\frac{1}{3}$ 10 shekels	432.00
Sweden	Foot	11.66	Kanna	158.00	Quintin	51.00
Heb.	4 palms	11.65	$\frac{1}{8}$ bath	151.20	8 gerahs	51.80
Leipsic	Foot	11.54	Anker	4110.00	Unze	450.80
Heb.	4 palms	11.65	248 logs	4116.00	70 gerahs	453.60
Hanover	Foot	11.49	Stubchen	237.20	Han	233.00
Heb.	4 palms	11.65	2 omers	240.00	36 gerahs	233.00
Lisbon	Foot	11.12	Armada	1009.00	Ocham	41.64
Heb.	Span	10.95	60 logs	1008.00	$\frac{1}{3}$ shekel	43.20
Vienna	Foot	11.27	Mass	86.30	Pfund	8644.00
Heb.	Span	10.95	5 logs	84.00	$\frac{2}{3}$ 100 shekels	8640.00
Naples	Foot	10.38	Caraffa	41.30	Trappeso	13.60
Heb.	$\frac{1}{2}$ cubit	10.31	$\frac{1}{10}$ seah	40.30	$\frac{1}{10}$ shekel	12.96
Bremen	Foot	11.38	Mass	12.28	Mark	3846.00
Heb.	4 palms	11.65	$\frac{1}{10}$ omer	12.00	30 shekels	3888.00
Constantinople	Parmack	1.233	Almud	319.40	Oke	19600.00
Heb.	$\frac{1}{100}$ reed	1.237	19 logs	319.40	150 shekels	19440.00
Britain	Foot	12.00	Quart	69.28	4 ounces	1920.0
Heb.			Quab	67.24	15 shekels	1944.0
United States	Foot	12.00	Gallon	231.00	Ounce	437.5
Heb.			14 logs	235.00	$\frac{1}{3}$ 10 shekels	432.0

The following diagrams show the system; the volume of each measure is correct, but of course its geometric form is presumed.

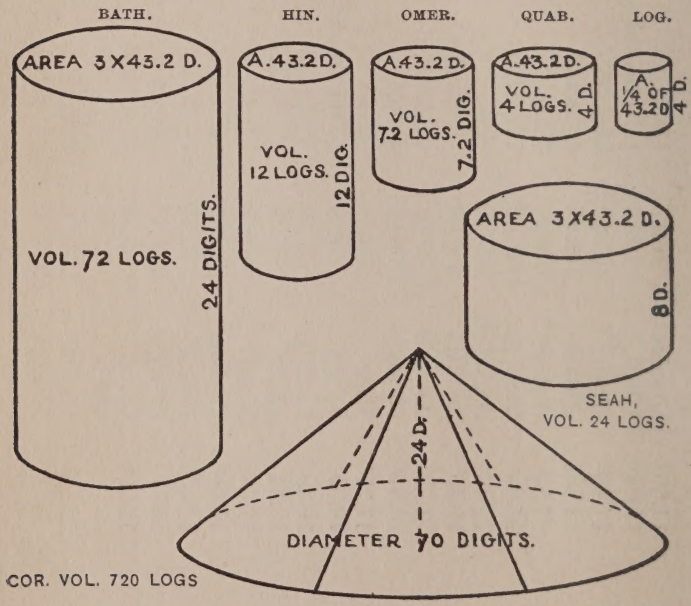


FIG. 6. HEBREW MEASURES OF VOLUME.

HEBREW MEASURES OF LENGTH.

1 Digit	=			= .73	in.
1 Palm	= 4	digits		= 2.92	"
1 Span	= 15	"		= 10.95	"
1 Short Cubit	= 24	"		= 17.52	"
1 Handbreadth	= 4.25	"		= 3.10	"
1 Cubit (Moses)	= 28.25	"		= 20.625	"
1 Reed	= 6	cubits		= 123.75	"

HEBREW MEASURES OF WEIGHT.

1 Gerah	=			6.48 grs.
1 Bekah	=	10 gerahs	=	64.80 "
1 Shekel	=	20 "	=	129.60 "
1 Maneh	=	100 shekels	=	12960.00 "
1 Talent	=	10000 "	=	1296000.00 "

NOTE. In the earlier ages of the Hebrew people a metallic medium of exchange was reckoned by weight. A shekel, gold, was 129.6 ± 2 grs. and the talent was 10000 shekels. The silver talent was approximately equal to the gold talent in volume and about one-half its weight. Areas were measured by length and breadth.

It may be well to call attention to a remarkable feature in some other ancient systems of metrology. The following classification of Mr. Petrie's large collection of weights found at Naukratis and Defenneh, Egyptian cities of international exchange, shows that a system of weights, in the relation of one, two, five, widely prevailed.

a. Kat $\frac{1}{10}$, $\frac{2}{10}$, $\frac{5}{10}$; 1, 2, 5; 10, 20, 50; 100, 200, 500.
b. Drachma $\frac{5}{10}$; 1, 2, 5; 10, 20, 50; 100.
c. Drachma? $\frac{5}{10}$; 1, 2, –; 10, 20, 50; 100.
d. Dirhem —; –, 2, 5; 10, 20, 50.
e. Shekel $\frac{5}{10}$; 1, 2, 5; 10, 20, 50; 100.
f. Drachma $\frac{5}{10}$; 1, 2, –; —, —, 50.
g. Shekel $\frac{5}{10}$; 1, 2, 5; 10, 20, 60; 125, 250.

---

h. Cent 1, 2, 5; 10, 20, 50.
h. Dollar 1, 2, 5; 10, 20, 50, 100, ——, 500, 1000.

NOTE. a. Egyptian, 144 grs.; b. Attic, 66 grs.; c. Asiatic, 78.54 grs., or Petrie's 80 gr. unit; d. Arabic, 45 grs.; e. Phoenician, 114 grs.; f. Aeginetan, 96 grs.; g. Assyrian, 126.4 grs.; h. United States, money values.

Intermediate weights also appear, thus $\frac{1}{4}$ and 4 kats; $\frac{1}{6}$, $\frac{1}{3}$, $\frac{2}{3}$ and 4 drachmas; 4, 8, 16 and 40 shekels, etc., evidently supplementary to the regular 1, 2, 5 series, and consisting of $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$ of a larger weight. The Hebrew system of measures of volume involved sub-divisions by thirds and fourths; thus, the seah was $\frac{1}{3}$ ephah, and the quab was $\frac{1}{3}$ hin, while the hin was $\frac{1}{2}$ seah, and the log was $\frac{1}{4}$ quab; but it combined the decimal division, for the ephah was $\frac{1}{10}$ cor, and the omer was $\frac{1}{10}$ ephah. The United States coinage of 2 and 20 cent pieces has been discontinued; the 25 cent coin corresponds to the "intermediate weights" of the ancient systems.

Babylonian metrology was closely allied to the Egyptian system; in some respect the two systems were identical. Circular measure was the same in both. The best exhibit of the Babylonian standard of length is the graduated rule of Gudea, on a diorite statue found at Tello, Babylonia, a relic of about 3000 B. C. The rule is a raised portion of the lapstone, triangular in section, 10.8 inches in length and about half an inch high. It has 16 aliquot parts. The second, fourth, sixth, eighth, and tenth from the right-hand side of the statue are respectively subdivided into sixths, fifths, fourths, thirds, and halves (Fig. 5), provides for very close measurements without fractions. The length of the rule is one-twelfth of 129.6 inches, or 3 times 3.60, which is a correlation like the Hebrew span 10.95 inches equal to 3 times 3.65. The number 360 stood for the year cycle of 12 months of 30 days each. The number 1296 with its decimal multiples represented the circle

of creation. It was held in great reverence by ancient Babylonians, and was identified with their civil, industrial, and religious systems. The school tablets from Nippur, already referred to, have many problems based on the number 12960000. One of those tablets has 24 examples in division based on the number 12960000 × 216000 × 70, that is, $60^7 \times 70$. All of these are identified with 1296, and we may reasonably infer that no small part of school work consisted in making the pupils familiar with the venerated 12960000 and its relation to Nature's order, and the duties of civil and religious life.

Numbers were frequently used by the Babylonians in the construction of symbolic edifices. The Ziggurat of Jupiter Belus, at Babylon, has an ideal basis in the number 360. In form it is a step-pyramid of seven stages; each of the six upper stages is 360 inches shorter than the one next below it; the base side is 3600 inches and the total height of the structure is 3600 inches. The entire system of ancient Babylonian metrology appears to have been derived from 360, or 12960000 = 360 × 360 × 100.

Mr. Petrie (*Inductive Metrology*, pp. 60–62) gives some interesting details of four cubit rods which bear special marks. The fifteenth digit of all the rods is marked as a "great span"; the tenth digit of all is marked as a "little span." The fifth digit of three rods bears the mark of 5 fingers as if it were $\frac{5}{10}$ of the "little span"; the sixth digit of three rods bears 5 cross lines as if it were $\frac{5}{10}$ of 12 digits, the half of the 24 aliquot parts; the eighth digit of one rod has 5 cross lines as if it were

$\frac{5}{10}$ of 16 digits or 11.68 inches, the ancient Roman foot; a difference of .02 or .03 inches in making a rod was not unusual. Now since 1 digit = .73 inch = $\frac{1}{5}$ of 3.65,

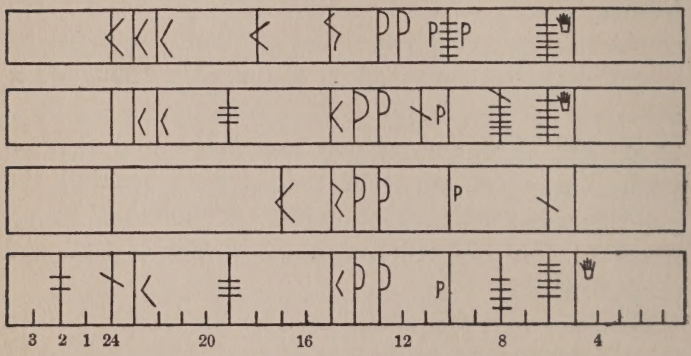


FIG. 7. EGYPTIAN CUBIT RODS.

5 digits = 3.65 (Petrie 3.7); 10 digits = 2 times 3.65 = 7.3 (Petrie 7.4); 15 digits = 3 times 3.65 = 10.95 (Petrie 11, or less); 6 digits = $\frac{6}{5}$ of 3.65 = 4.38 (Petrie 4.4); and 24 digits = $\frac{24}{5}$ of 3.65 = 17.52 (Petrie 17.5, about).

Near the thirteenth digit all the rods bear a "great span" mark at 9.6 inches from the end, which is .03 + .8862 times 10.8, the Gudea rule of ancient Babylonia. In other words this "great span" mark is the measure of a square whose area is equal to a circle having the diameter 10.8 inches = $\frac{1}{12}$ of 129.6, or 3 times 3.60. The eighth digit of one rod bears 4 cross lines as if it were $\frac{4}{10}$ of a larger measure. Now the Roman palmipes was 14.52 inches, and $\frac{4}{10}$ of it is 5.808, which agrees well with 8 digits = 5.84 inches, (Petrie 5.9). The nineteenth digit of two rods bears 3 cross lines, as if it

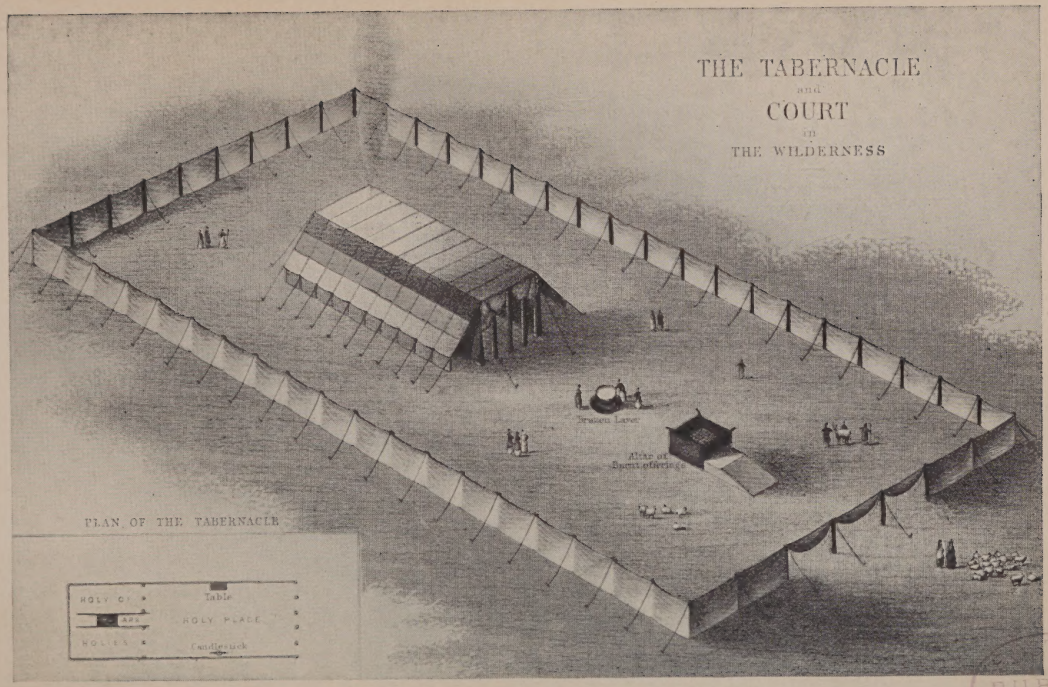
were $\frac{3}{10}$ of a larger measure. Now the side of a square being 36.5 inches, a circle of equal perimeter has the diameter 46.47 inches and $\frac{3}{10}$ of this is 13.94 inches, (Petrie nineteenth digit is 14 inches). By this analysis all the cross lines denote tenths of larger measures which were of great importance in Roman as well as in Egyptian metrology.

The origin of the British inch is unknown, but its close relation to the Hebrew cubit is remarkable, for the diameter of a circle being 20 cubits, the measure of the Most Holy in Solomon's temple, its circumference is 1296 in., which is just 120 Gudea rules. The Gudea rule, 10.8 in., was the ancient standard of lineal measures in Babylonia, where the Hebrews were in captivity many years. There is a tradition that after that captivity some Hebrews settled in England, as they did in European countries. The Comacine architects were familiar with the number 1296, since it often appears by inch measures in the cathedral plans. The circumference of Stonehenge by the inch is equal to the number of days in 10 years. Whether this unit be of Egyptian, Babylonian, Hebrew, Italian, Roman or Druidic origin its identity of measurement is preserved almost if not altogether without a fault, and, not less remarkable than this, is its beautiful correlation with the harmony of Nature and the most ancient and modern divisions of time and the circle; the foot of 12 inches was a natural sequence, one-half of the number of aliquot digits in the cubit of Egypt. The Gudea rule, 10.8 inches, as $\frac{1}{12}$ of 129.6 inches, is a remarkable witness not only of the great antiquity of the inch unit

inherited by the Anglo-Saxon race, but of the preservation of its integrity through five millenniums of national wreckage. Thus in everlasting diorite speaks the Gudea rule of 3000 B. C.

For measures of weight the grain unit appears to have been universal. Its correlation with circular-measure in the Hebrew shekel 129.6 grains, the Persian daric 129 grains, the Greek didrachm 129 grains, the original English guinea 129.6 grains, and the American half eagle 129 grains, is notable.

NOTE. — The preservation of the ancient grain unit may be largely due to the religious tenacity of the Hebrew race. When Daniel was set over the princes of Babylonia to "do the king's business," and was retained in his high office half a century or more, his opportunity for good was beyond precedent. There seems to be sufficient evidence for belief that he established throughout the empire of Nebuchadnezzar and of Cyrus the Persian, Ezekiel's law of weights: 20 gerahs for a shekel, 20 shekels, 25 shekels and 15 shekels for a maneh, altogether 60 shekels. On the basis of 129.6 grs. for a shekel, these weights, 129.6, 2592, 3240, 1944 and 7776 grs. by tenths and hundreds, and their multiples are found in abundance in Mr. Petrie's collection of Assyrian weights taken from the ruins of Naukratis and Defenneh, Egypt's ancient depots of eastern trade. They also appear in the Macedonian coins of the sixth and fifth centuries B. C., the period to which the weights of Naukratis and Defenneh belong. An inspection of the weight column on pp. 80, 81 shows that Ezekiel's weights were incorporated into the old European systems of weights and measures. In this we may see how impossible it is to eliminate ancient Hebrew ideals from the historical development of civilization. The origin of the grain unit is uncertain, but it may be due to the weight of a cubic digit of sea water at blood heat, which is 100 grains, the digit being .729 ± .001 inch.



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CHAPTER VI.

HEBREW SYMBOLISM.

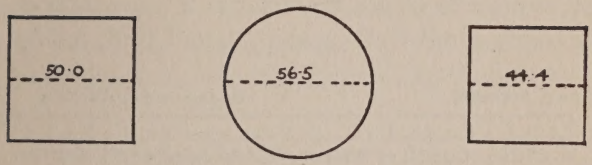


FIG. 8. CIRCLE WITH SQUARE OF EQUAL AREA (ON LEFT) AND EQUAL PERIMETER (ON RIGHT).

THE Mosaic tabernacle was erected by the Hebrew people in the beginning of their forty years' sojourn in the wilds of Arabia. They had just emerged from a grievous oppression in Egypt, but before assuming national responsibilities they were in sore need of preparation. The foundation for this was the religious recognition of God as their sovereign Ruler. The tabernacle with its appointments was created for the promotion of civil and religious unity, the worship of Jehovah, and the ritual manifestation of the Divine Presence. The pattern and details of its construction were revealed to Moses in numerical terms. The unit of measurement was the cubit (Fig. 9), a rod 20.625 inches in length, equal to 28.25 digits, *i. e.*, 5 times 5.65, the numeric symbol of Divine sovereignty. The tabernacle stood within a court (Frontispiece and Fig. 9), 50 by 100 cubits, fenced about with posts 5 cubits high, set 5 cubits apart and joined with twined linen. This enclosure comprised two squares 50 by 50 cubits, the area

of each being equal to a circle whose diameter is 56.5 cubits, *i. e.*, the numerical form of H V H, the Absolute One, God; thus the measure of the court signified that God is with His people. The tabernacle was an enclosure of three areas 10 by 10 cubits, each area being equal to a circle whose diameter is 2 times 5.65 cubits, the numeric symbol of sonship, 2, and God, 5 6 5. Its

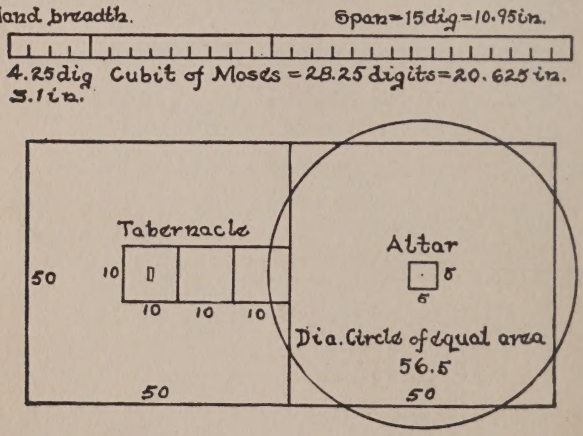


FIG. 9. PLAN OF TABERNACLE AND COURT.

walls were constructed of wooden forms 1.5 cubits wide and 10 cubits high, held in line by strong horizontal bars of wood. It was covered with skins sewed in strips 4 cubits broad and 30 cubits long, laid transversely over the whole from north to south. (Frontispiece.) The entire breadth of the covering, east to west, was 44 cubits, and fell somewhat over the ends of the enclosure; it was supported by a ridge-pole running through the length of the structure and resting on posts but little

higher than the walls. An interior lining of ten pieces of linen, 4 cubits wide and 28 cubits long, was secured to the ridge-pole and draped to the wall on either side. The eastern end of the structure was hung with curtains and opened upon the court; this was the only entrance. The interior was in two compartments; the outer one, called the Holy Place, comprised two of the three squares; the inner one, the Most Holy Place, was separated from it by a veil.

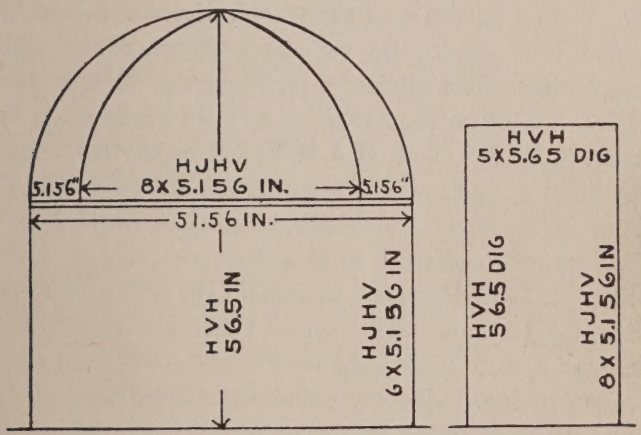


FIG. 10. THE ARK AND MERCY-SEAT, AND THE ALTAR OF INCENSE.

Within the Most Holy Place was the Ark of the Covenant (Fig. 10), on which rested the Mercy-seat. Its length was 2.5 cubits, the breadth 1.5, and the height 1.5 cubits. The length was 51.56 inches, *i. e.*, the numerical form of "The J H V," *i. e.*, H J H V, 5, 1 5 6, and the breadth or height gave it a volume of 12 times 10560 digits, *i. e.*, the numerical form of covenant, 12, and fullness of J H V, 10 × 1056.

The Mercy-seat or seat of Divine communication was a plate of solid gold, covering the ark and bearing cherubic wings which rose from each end and met above in the midst. Thus the ark and mercy-seat in the Most Holy Place were religiously connected with the Divine Presence and the word issuing therefrom.

The Altar of Incense (Fig. 10) stood before the veil, and represented perpetual access to Jehovah; it was 1 cubit square and 2 cubits high. Its measure round about was 4 cubits, or 2 times 56.5 digits, *i. e.*, sonship, 2, and God, 56.5. Its vertical measure round about was 3 times 56.5 digits, *i. e.*, harmony, 3, and God, 56.5. A similar interpretation by inch measures is harmony, 3, life, 8, and H J H V, 5 1 5 6. Its volume was 2 cubes, each cube measuring on its edge 4 times 5.156 inches, *i. e.*, the house, or altar, 4, of H J H V. The incense to be used on this altar consisted of myrrh 500 parts, cummin 250, calamus 250, cassia 500, and olive oil 12 logs. The gums were, by weight, multiples of 5, and their total weight was 1500 shekels or 194400 grains. The log contained 4224 grains, *i. e.*, 4 times 1056, of pure water at blood heat; hence the weight of the olive oil was 50688 grains, and the total mixture was 245000 grains or 50 times 70 times 70. The numeric symbolism of this is 50, God's field, the measure of a square equal in area to the circle whose diameter is 56.5, and 70 times 7, perfect reconciliation. All this symbolism is in thorough accord with the purpose of the daily sacrifice and of all other ritual acts belonging to the tabernacle. It appears to indicate what the measures signified.

The Table of Shew-bread (Fig. 11) stood outside of the veil, and represented the vital truth that the life of God's people depends upon communion with Him. It was 2.5 cubits long, 1.5 high, and 1 cubit wide. Its length was 51.56 inches, the numerical form of H

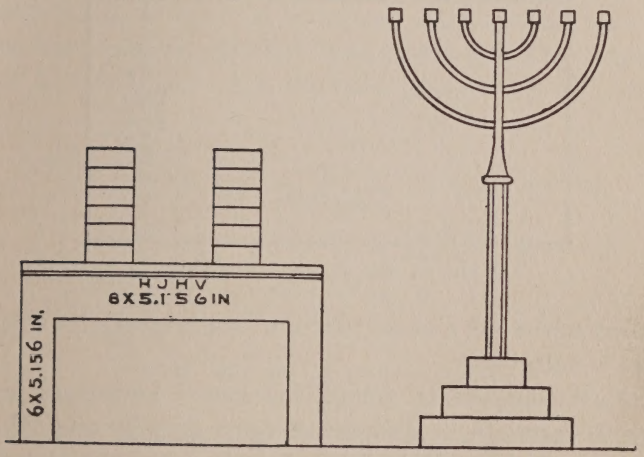


FIG. 11. TABLE OF SHEW-BREAD AND CANDLESTICK.

J H V; and its volume was 8 times 10560 digits, *i. e.*, symbolically, life, 8, J H V, 1056, and fullness, 10. Thus in numeric language, the table of shew-bread was supremely the table of communion with Jehovah.

Over against this table stood the Golden Candlestick (Fig. 11) bearing the 7 lights to represent God's sevenfold, abundant, illumination of His people.

The Altar of Sacrifice (Fig. 12) stood within the court. It was 5 cubits square and 3 cubits high, numbers that signify sovereignty, 5, and harmony, 3. The base of this altar, 5 by 5 cubits, was a square equal to

the area of a circle whose diameter is 5.65 cubits, that is, God's area, or ground. Between this altar and the

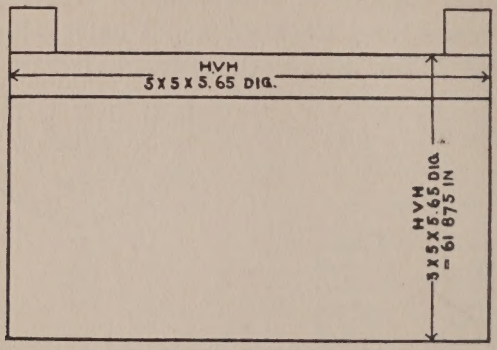


FIG. 12. THE ALTAR OF SACRIFICE.

tabernacle stood a brazen laver or wash bowl; its measure is not given.

Most conspicuous among the sacred vestments was the Breastplate of Judgment, worn only by the High Priest. It was a linen fabric 1 span square, bearing 12 jewels which were arranged in rows across its face. It represented the supreme authority of God in the civil and religious government of the Hebrew people. It was to be used in religious ceremonies, and when important matters came before the High Priest for judgment. The manner of using it is uncertain, but probably it served to arrest the attention of the High Priest, assist him in fixing his mind wholly upon the subject before him and enable him under Divine inspiration to render just judgment. Thus in the presence of God he carried all Israel on his heart, the names of the 12 tribes being engraved upon the jewels. The

solemnity of this use of the breastplate was called seeking judgment by Urim and Thummim.

Urim is the plural of A U R, light. The numerical form of A U R, is 162, a number identified with 1296, as $8 \times 162 = 1296$, *i. e.*, light, 162, of life, 8. The breastplate being one span square, the circumference of the circumscribing circle is 4.44 spans, *i. e.*, the numerical for Th M M, 4 4 4, the verb from which thummim

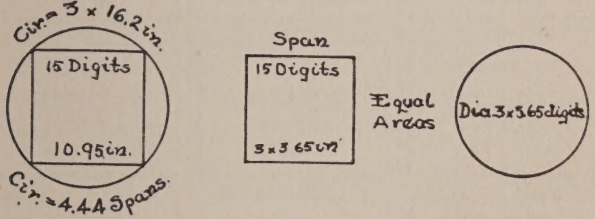


FIG. 13. GEOMETRY OF THE BREASTPLATE.

is derived signifying to be righteous or perfect. Thus urim and thummim, by numeric symbolism, denote a life of perfect light. In seeking judgment by urim and thummim the inner life of the High Priest must not be disturbed, nor the power of right judgment impaired by unrighteous thoughts, for quietness of mind is necessary to inspirational receptivity of soul.

Taking the span to be 15 digits or 10.95 inches (Fig. 13), the circumference of the circle that would circumscribe the breastplate was integrally 3 times 16.2 inches, *i. e.*, light, A U R, of perfection, 3; it was also integrally equal to 4.44 times 10.95, *i. e.*, the span of thummim, 4.44, the perfect, the righteous. The area of the breastplate is integrally equal to a circle whose

diameter is 3 times 5.65 digits; thus by numeric symbolism it represents the field of Divine harmony. The area of each of the twelve sections into which the breastplate is divided is equivalent to the square of 4.32, *i. e.*, the symbol of consecration.

PRIESTLY **LEVI** CARBUNCLE Bright Red	REGAL **JUDAH** TOPAZ Pale Green, Yellow, Sapphire	LONG LIFE **REUBEN** SARDIUS Blood Red
PROSPEROUS **ZEBULON** DIAMOND White or Yellow	FRUITFUL **JOSEPH** SAPPHIRE Blue	BELOVED **BENJAMIN** EMERALD Bright Green
DANGEROUS **DAN** AMETHYST Purple, Violet, Sapphire	STRIVING **GAD** AGATE Spotted Brown	TENT-LIFE **ISSACHAR** LIGURE Orange Red, Red, Sapphire
FIERCE, HATED **SIMEON** JASPER Grey Quartz	CHILDREN **ASHER** ONYX White, Brown, Black	SATISFIED **NAPHTALI** BERYL Green

FIG. 14. THE BREASTPLATE.

The probable arrangement of the names and jewels was this: beginning with Reuben on the right and reading to the left in the order observed by Moses in his prophetic blessing, together with the character he assigned to each tribe, and its appropriate jewel.

The diamond is a carbon crystal of 8 sides, and isometric; all the others are silicate crystals of 6 sides,

and prismatic. In numeric symbolism 8 is life, hence the diamond fitly represents, by its whiteness and purity, the prosperity that comes from hidden life in God. The six-faced prisms, 2 times 3, represent sonship, 2, harmony, 3.

In colors of the first group, the blood-red of Reuben, the first-born, the beginning of Jacob's strength, denotes race perpetuity; the topaz, a combination of green and yellow, of Judah, imperishable royalty; the scarlet of Levi, the priestly authority. Fruitfulness is the dominant tone of the second group; contention marks the third group, and satisfaction the fourth group, except Simeon who, probably on account of his fierce temper, was not included either in Jacob's or Moses' final blessing.

The measure of the breastplate, one span, has been generally reckoned equivalent to half a cubit. Two cubit rules were included in the old Egyptian system of measures: a short cubit of 24 digits or 6 palms, and equal to 17.52 inches, and the longer cubit of 20.625 inches. The Hebrew cubit had the same measures — a cubit of 24 digits and the cubit of the sanctuary, which was the handbreadth longer. The rabbins reckoned the span equivalent to the extreme stretch of the thumb and little finger, which would identify it with half the short cubit rather than half the longer cubit. Now the cubit used in the vision of Ezekiel included the handbreadth, and was the cubit Moses used for the construction of the tabernacle and its appointments. It had two principal divisions, the handbreadth and the short cubit of 24 digits. Another division appears on the

old cubit rules of Egypt, consisting of 15 digits on the end opposite to the handbreadth. This division must have had a name and use as distinctive as the handbreadth; its length was 10.95 inches. It is identified with travelling measures, for the Hebrew mile was 4000 short cubits; the Sabbath day's journey was 4000 measures of this 15 digit division, and 48 Sabbath days' journeys, or 192000 of this division, made a day's journey in Hebrew road measure. The Hebrew mile was 6400 of this division. Thus the measure of 15 digits was an integral factor of Hebrew travelling measures. We may be ignorant of its origin, but 10.95 is 3 times 3.65, a number identified with the measure of the earth's annual motion. The distinctive name of this 15 digit measure is not recorded, unless it be the span of the breastplate. The Hebrew name *zereth*, span, was used by Moses and Ezekiel as a distinctive measure exclusively associated with the breastplate and Ariel, God's hearthstone or high place on the altar. All other measurements described by Moses or Ezekiel were in terms of the cubit or half-cubit. It appears, therefore, that the span stood in close relation to the most sacred appointments of Hebrew ritual. The Jewish Encyclopedia gives the span a measure of 11.029 inches, which differs from 10.95 inches by less than one-twelfth of an inch. Analogous to this was the distinctive measure of the *omer*, 7.2 logs, *i. e.*, one-tenth of the *ephah*, the large grain measure; the *omer* represented the Lord's tithe.

It is difficult to accept as inspired of God the numeric details appertaining to the tabernacle of Moses

without feeling that by number and by measure God made a revelation of spiritual things quite in accord with the numerical harmonies displayed in the order and law of His physical creation.

HEBREW SACRIFICES.

The sacrificial system established for a continual exhibit of Divine and human relations was symbolic in a high degree. It provided for the religious ministrations of the tabernacle and the support of those who served at the altar. All offerings were made unto the Lord. The sacrificial food for consumption was prepared with the utmost regard to cleanliness.

The stated offerings were three-fold: flesh from the flock or herd for the burnt offering, flour mixed with oil for the meat offering, and wine for the drink offering. The three were united in fixed proportions, thus:

BURNT OFFERING.	MEAT OFFERING.	DRINK OFFERING.
1 lamb.	1 omer flour.	$\frac{1}{4}$ hin oil and $\frac{1}{4}$ hin wine.
1 ram.	2 " "	$\frac{1}{3}$ " " " $\frac{1}{3}$ " "
1 bullock.	3 " "	$\frac{1}{2}$ " " " $\frac{1}{2}$ " "

The lamb symbolized the deliverance of the Hebrews from Egyptian oppression, and represented God's saving presence. The omer was one-tenth of the ephah and represented the Lord's tithe. The hin contained 12 logs and represented the covenant of God. All flour offerings were measured by the omer and all wine offerings by the hin (Fig. 6); thus the Hebrew's covenant relation to God, and his obligation to serve, were continually declared in the sacrificial use of these vessels.

Taking the measures by weight, the log contained 43.2 cubic digits of pure water at blood heat, weighing 4224 grains or 4 times 1056, *i. e.*, the house, 4, of J H V, 1056; the hin of 12 logs was a symbol of the covenant, 12, of the house, 4, of J H V, 1056. The omer contained 7.2 logs, and its weight of water was 30412.8 grains, *i. e.*, $\frac{1}{10}$ of 2 times 144 times 1056, the likeness, 2, of Israel, 12 times 12, and J H V, 1056.

The lamb offering was daily, morning and evening, throughout the year; it represented a daily benediction of health and peace. The Sabbath, or seventh day, bore a double blessing by an additional lamb morning and evening. A monthly offering of two bullocks, one ram, seven lambs and a kid, for a sin offering, was made in addition to the daily sacrifice. This celebration was called a holy convocation. The kid represented forgiveness, the bullock represented labor, the ram stood for defence, and the whole signified national consecration. The flour required was 108 logs, or 9 times 12, *i. e.*, the organic unity, 9, of the covenant, 12.

The great annual festivals in Hebrew national life were the Passover, the Feast of Pentecost, the Feast of Tabernacles, and the Day of Atonement. The Passover offerings were like the monthly celebrations, but took a goat instead of a kid for a sin offering. This feast was observed seven days, and carried with it not only forgiveness but reconciliation by the offering of 7 times 7 lambs; thus the Passover was supremely a spiritual benediction of peace and good will.

The Feast of Pentecost was observed on the fiftieth day after the Passover, in commemoration of the giving

of the Law on Mount Sinai. The numeric symbolism of 5 is law, order, government, sovereignty, and 50 is the symbol of the fullness of God's sovereignty, the country in which all questions are settled by His law. The sacrifices of this feast were the same as at the Passover, but for only one day. It was called "First Fruits," and included a blessing and a thanksgiving for the fertility of the land.

The Feast of Tabernacles was kept at the close of the harvest, and continued seven days. Satisfaction was its dominant ideal, and the people coming from every quarter lived in booths during the festival. It was the most jubilant of all the feasts. There was a daily offering of two rams, fourteen lambs and one kid, but the bullocks were thirteen the first day, twelve the second day, and one less each day, so that there were seven on the seventh day, and altogether seventy in the seven days. On the eighth day there was a Holy Convocation, and the offering was one bullock, one ram, seven lambs and one goat. Though a reminder of tent life in Arabia, the seven-ness of this festival expressed its distinguishing character — satisfaction, contentment, peace, and thanksgiving for God's gracious care. Seven being the symbol of rest or peace, the bullocks on the first day were $13 = 6$ and 7, *i. e.*, the day of peace; then $12 = 5$ and 7, the law of peace; $11 = 4$ and 7, the house of peace; $10 = 3$ and 7, the perfection of peace; $9 = 2$ and 7, the son of peace, and finally 7, peace itself.

Not less remarkable was the symbolic use of 7 in connection with the Sabbatical year, which began on

the seventh day of the seventh month of the seventh year. It was to be a year of rest to the land and to the tiller of the soil. In its time the payment of a debt was not to be enforced, slaves were to be free men, and the spirit of rest was to prevail in all departments of life. Its observance in Canaan began the seventh year, at the close of the seven years required to recover the lands which had belonged to their fathers, Abraham, Isaac and Jacob, before the long sojourn in Egypt.

At the expiration of seven Sabbatical years the great year of Jubilee was proclaimed on the tenth day of the seventh month, the Day of Atonement. It was to be a year of rest and peace. After the recovery of their lands, the country from Dan to Beersheba was divided among the tribes by their families. The occupant of a parcel of land could not sell it, but he could sell his right of occupancy for a term of years not extending beyond the year of Jubilee; if, however, he desired to recover to himself his right to occupy, he could do so by returning to the lessee a sum proportionate to the unexpired term of the lease. There was no absolute ownership of land, it was the Lord's, and the holder of a parcel of ground owned nothing more than the right to occupy it and sell or use its products. The year of Jubilee was the settlement of individual strife and litigation. The law that established the Sabbatical and Jubilee years for the Hebrew Commonwealth was based on a high ideal of civil and sociological harmony, but human cupidity and ambition soon led to its practical suspension.

The Day of Atonement was a solemn observance on the tenth day of the seventh month; it was the great day of reconciliation, when the High Priest made sin offerings for himself, his family and the people, entered the Most Holy Place, enveloped the Mercy Seat with clouds of incense, and sprinkled it seven times with the blood of the sin offering and seven times with the blood of a young goat, and also, according to Josephus, the floor and ceiling seven times with the blood, and seven times sprinkled the blood towards the Most Holy after he had come out from the veil. He also sprinkled the Holy Place, and poured the blood seven times upon the great altar that stood in the court. All this was the ritual of peace between God and all the congregation of Israel, the solemn expression of Hebrew faith and repentance, and of God's mercy and forgiveness. In the abatement of the consequences of wrong-doing it was the day of sevens, of peace, and at-one-ness with God. It was a blessed reality, and closed with the scapegoat ceremony of putting out of sight the sins of the people, that they should no more be had in remembrance before the Lord.

THE TEMPLE OF SOLOMON.

The national life of the ancient Hebrew people reached its climax in the reign of King Solomon. His crowning act, 1004 B. C., was the erection of a temple to the worship of Jehovah. Its architectural design and appointments had been revealed to his father, King David. It was a small edifice, being only 40 by 110 feet. The walls were hewn stone lined inside with

wood overlaid with gold. The interior comprised three squares (Fig. 15) 20 by 20 cubits each, one of which was screened off for the Most Holy Place, the other two being the Holy Place. The height of the Most Holy

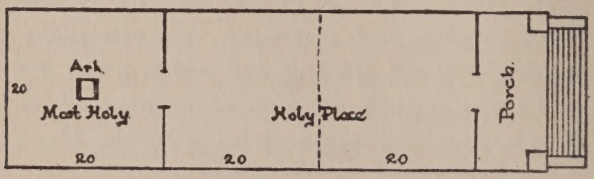


FIG. 15. TEMPLE, GROUND PLAN OF INTERIOR AND PORCH.

Place was 20 cubits. The square 20 by 20 is the area of a circle whose diameter is 4 times 5.65, *i. e.*, house of God. The sum of the diagonals of this square is 56.5. The cubic measure of the Most Holy Place was 80 x 80 x 80 cubes of 5.156, *i. e.*, the fullness, 10, of

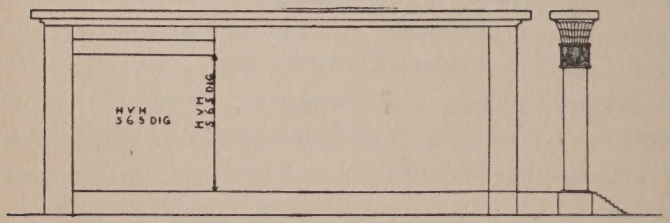


FIG. 16. ELEVATION OF THE TEMPLE.

the life, 8, of The J H V, 5.156. Herein the Mosaic Ark of the Covenant was set, containing the Law. At each end of the Ark stood a golden cherub, ten cubits high, with wings outstretched. A two-leaved door opened out to the Holy Place; each leaf was two cubits wide, or 8 times 5.156 inches, *i. e.*, the life, 8, of The

J H V. The whole was overlaid with gold, and, like walls and ceiling of the edifice, bore in all parts the symbolic cherub and palm, Divine life and victory. The Holy Place contained the table of shew bread, the altar of incense, and 5 lights on either side, the symbol of the guiding light of the 10 Commandments. The entrance to the temple was 5 cubits wide, or 4 times 5 × 5.156 inches, *i. e.*, the house, 4, of the sovereignty, 5, of The J H V, 5.156.

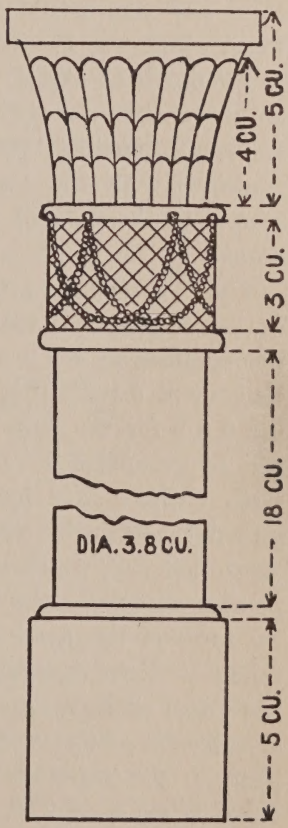


FIG. 17. JACHIN AND BOAZ.

The porch in front of the temple comprised two squares 10 by 10 cubits, the area of each square being that of the circle whose diameter is 2 times 5.65, *i. e.*, sons of God, signifying that they who enter the temple must be sons of God. At the porch stood two memorial pillars which Solomon named Jachin and Boaz (Fig. 17). Each column was 12 cubits round about, *i. e.*, the covenant number, and was surmounted with a capital 5 cubits high, lily-shaped, which rested on a pommel 3 cubits high, numbers symbolizing sovereignty and harmony. Each pommel bore 7 chains of pomegranates, 14 chains

on the two capitals, coincident with St. Matthew's 14 generations from Abraham to David. A generation being reckoned as the days of man, 70 years, or three score and ten, would give 980 years for 14 generations, which was the cycle from the birth of Abraham to the death of David. The number of pomegranates on the chains was 400. The pomegranate was the symbol of fertility, prosperity, and the number 400 coincides with the years from the building of the temple to the date of its spoliation by the Assyrian armies.

The symmetrical arrangement of 200 pomegranates on seven chains is easily accomplished by placing a pomegranate at the seven points of suspension of the chains and distributing the remaining 193 in groups of 6 5 6 5 6 for the first, third, fifth and seventh chains, and in groups of 5 6 5 6 5 for the second, fourth, and sixth chains; thus four chains would bear 28 pomegranates each, and three chains would bear 27 each, altogether 193, which with the 7 at the points of suspension completes the full number, 200. The numerical form of the name Jachin, J K I N, is 1215, which taken in digits is equivalent to 43.0 cubits, *i. e.*, like the years of Egyptian sojourn, 430, from the time of Abraham's going to Egypt, 1921 B. C., in his 75th year, to the Exodus, 1491. The numerical form of Boaz, B Ay Z, is 277, which taken in digits is equivalent to 9.80 cubits, *i. e.*, like the years of the Hebrew cycle, 980 years, from the birth of Abraham to the death of David. These data appear to give to Jachin and Boaz a truly memorial character.

In the court of the temple stood a large water tank, of cast brass, circular in form and 5 cubits deep (Fig. 18). Its diameter was 10 cubits including the rim, which was a handbreadth wide, 3.1 inches, and lily-shaped. The measure of the opening round about inside of the rim was 30 cubits. It held 144000 logs of

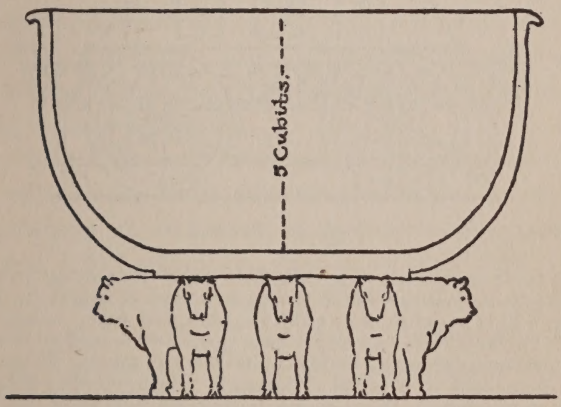


FIG. 18. THE MOLTEN SEA.

water, the log being, according to Maimonides, 43.2 cubic digits. These data require the tank to be slightly curved inwardly towards the bottom, and the bottom to be considerably flattened. It rested on 12 oxen, according to the number of the tribes of Israel.

The log being the measure of oil prescribed for anointing in the consecration of the High Priest, was the symbol of consecration; hence the measure of the great sea, 144000, represented all Israel as a consecrated people.

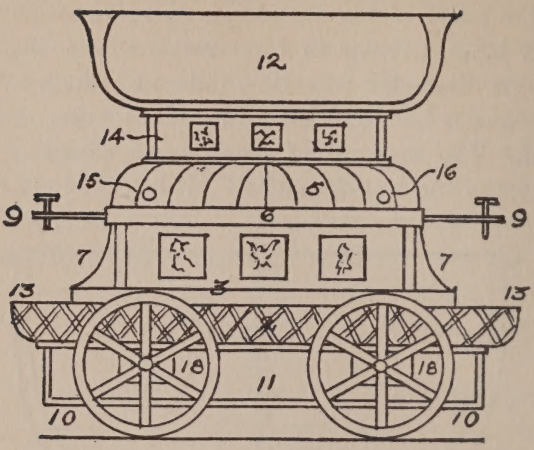


FIG. 19. LAVER.

The laver 12, was set on a brass base (support) resting on wheels 10, 10 [the numbers refer to the figure] that it might be moved about. This support, four cubits square and three cubits high, was in two sections — an upper base (pedestal) 5, and a lower base (support) comprising all the parts between 11 and 6. These bases were connected by a ledge (joining) 6. Between this ledge and the lower ledge, 3, there was a border (an enclosing) on which were gravings of lions, oxen and cherubim, in squares. At the corners of this border were four undersetters (shoulders) 7, 7, to support the upper base. On the lower base and beneath the lower ledge, 3, there was "thin work" (light festoons or hangings) 2. The axletrees of the four wheels were joined to the brass base by four undersetters 18, 18. The faucets 9, 9, gave running water to wash the sacrifices ; the pans 13, 13, receiving it. The upper base (pedestal), above the ledge 6, was circular, its mouth (upper part) having an opening to receive the bottom of the laver ; its border (enclosing) 14, having gravings of lions, cherubim and palm trees, in squares ; the lower part, 5, of this base had "thin work" (light festoons). The laver, 12, was four cubits (extreme diameter).

The form I have adopted for the lip of the laver is lily-shape, like the molten sea, but with an inward curve which would prevent an overflow of water if the tank were brought to a sudden stop even though quite full. The cut is an imaginary sketch and a somewhat faulty attempt to follow the description I Kings vii: 27–38 ; the decorative work below the graven borders would be represented better by festoon lines.

Ten small tanks, lavers (Fig. 19), holding 40 baths each, and provided with faucets and pans for washing the sacrifices, were set on wheels that they might be moved about wherever there was need. The number 40, equal to 8 times 5, — life, 8, appointed, 5, — was the symbol of the preparation for a higher and more sacred service. All animal sacrifices were cleansed in running water before being offered, and these movable tanks with faucets and pans to receive the water were necessary appointments. The English translation is shovels, instead of faucets.

The great Brazen Altar on which the sacrifices were offered, stood in the temple court; it was 20 cubits square, an area equal to a circle whose diameter is 4 times 5.65 cubits, *i. e.*, altar, 4, of God, 5.65. The height was 10 cubits or 4 times 51.56 inches, *i. e.*, altar, 4, of H J H V, 5.156. Its cubic measure was 4000 cubits equivalent to $5 \times 8 \times 100$, *i. e.*, sacrifice full and complete, 100, is the law, 5, of life, 8. Perpetual oblation to Jehovah in substance and in person was the prime ideal on which the entire system of Hebrew worship rested. The symbolic character of Hebrew ritual and architecture was an object lesson of great importance, and not less legitimate than placing letters to make a word and words to make a sentence in written language.

The number 1000 being the cube of 10, completeness, is the numeric symbol of containment, full and complete. When applied to people it represents a full group without regard to the exact number of individuals embraced in the group; thus, Moses appointed

rulers or heads of thousands, one for each tribe, and captains of hundreds, one for each grouping of families within a tribe. The term "thousand" was the technical name of a large grouping. This mode of reckoning appears to be followed in the record of details concerning the groups of workmen employed, and the silver and gold provided for building the temple. Solomon made a levy of 30 "thousand" Israelites for timber cutting in Lebanon, and a conscription of 80 "thousand" Gebalites for stone-cutting, and 70 "thousand" for carriers. The timber-cutters were in courses, 10 "thousand" a month; the other workmen may have served in like manner; then 60 "thousand" were in constant work. Allowing 200 working days for each of the 7 years, the total of 84000000 days' work would give 420000 years of individual labor. The builders, metal workers, and workers of fabrics do not appear to be included in the "thousands." It is difficult to see how so much labor could be expended on a building only 40 feet wide, 110 feet long, and 50 feet high. It is difficult to see how the enormous sum of 5000 million dollars in gold and 2000 million dollars in silver could be expended on the work. Such a volume of gold would be sufficient to make the walls of the temple of solid gold one foot thick, while the silver would be nearly enough to fill it. But if instead of thus interpreting thousand literally, we take it as applied to workmen to signify a full complement, company or group of men, and as applied to the gold and silver to signify measures full and abundant by talents, the difficulty disappears, and the record becomes altogether

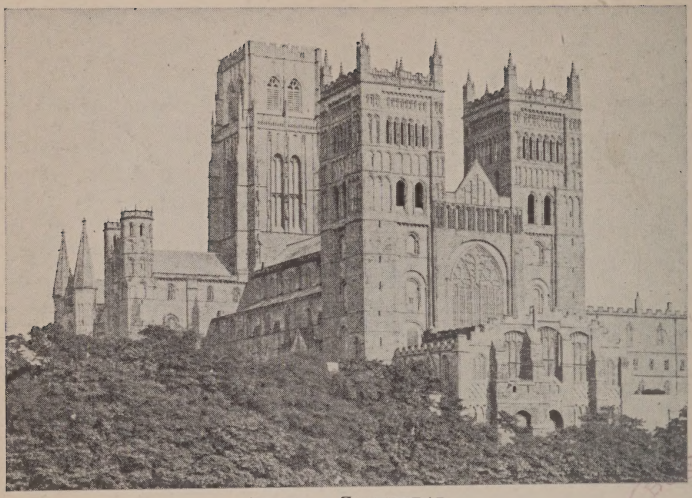
rational. The custom of using numbers in a symbolic sense, prevailing as it did in Hebrew ritual and history, may well lead to the belief that the term "thousand" in this record was so used.

The coincidences I have noted in Hebrew ritual and architecture, with their interpretation, spring naturally from the relation which the numeric value of the Hebrew letters bear to the digit and inch measure of the cubit, 5 × 5.65 giving the digit measure 28.25, and 4 × 5.156 giving integrally the inch measure 20.625.

When we consider, as we shall show in the following chapters on monumental work, that numeric symbolism had a dominant place in ancient Oriental life, and was used to express civic relations and the fixed order of natural law, its application to spiritual things in the Hebrew economy would obviously follow. The symbolic character of a numeral would be understood, and the spiritual significance of a measure or number Divinely given in ritual appointments would be recognized. In the Hebrew mind the J H V of creation was identified with the J H V of Israel. The God of the sea and everlasting hills was the God of the Breastplate and Altar.

NOTE. — The numerical use of a name in ancient civilization is seen in the Sargon inscription which says he built the walls enclosing his palace by measure according to "the number of his name." The use of the number 129.6 is seen in the small Assyrian mana which according to F. H. Weissbach weighed 504 grammes or 7778.23 grains, and was therefore almost identical with Ezekiel's maneh of 60 shekels, equal to 7776 grains, the shekel being 129.6 grains. Ezekiel's system of weights comprised one of 15 shekels, equivalent to 1944

grains, or 12 times 162, — that is symbolically, the covenant 12, of light, A U R, 162 ; another of 20 shekels, or 2592 grains, that is, 12 times 6 × 6 × 6, the covenant of man ; and a third weight of 25 shekels, equivalent to 4320 grains, or 12 times 360, the covenant of time. The fourth weight, 60 shekels, was the sum of the three smaller ones, and contained 7776 grains, equivalent to 12 times 3 × (6 × 6 × 6), the covenant of God, 3, and man, 6, 6, 6. The number 1296 appears in the weight of a cubic digit of water at maximum density, the digit being .675 inch, or one-sixteenth of the Gudea measure, 10.8 inches ; one hundred of these digits weigh 7771.44 grains, which gives a shekel of 129.52 grains.



DURHAM CATHEDRAL.

NETTLEY ABBEY.

FIG. 20. CATHEDRAL AND ABBEY.

CHAPTER VII.

NUMERIC IDEALS IN ARCHITECTURE — ENGLISH CATHEDRALS.

THE cathedrals of Italy, Germany, France and England belong to mediaeval art and constitute a unique class in the history of architecture. The pointed arch was unapplied, if known, before their appearance. They sprang into being like an inspiration, and in a comparatively short time they attained their perfect development. The generic unity displayed in their designs may be regarded as the product of one masterful spirit dominating a guild of builders trained for their work along ideal lines of harmony. Who were those great master builders?

In the eighth century A. D., there lived on the island of Istria, in Lake Como, a brotherhood of skilled masons who for twenty years resisted the Lombard invasion of Italy; but when overcome at last, they retained a large measure of their self-government. In the ninth and tenth centuries they extended their art into Germany and France, and later into England; they were called Comacines. Monks, abbots, priests and bishops became members of the fraternity and learned the mysteries of the craft. The superiors of the guild were titled *Magistri Comacini*, Master Builders. They designed the work, made contracts, and directed the construction of the edifices. They had a knowledge of geometry and all that was needful for

the execution of their plans. They were men of Christian faith, intensely religious in their professional tasks, even suffering death rather than debase their skill to the erection of temples for pagan worship. Christian inspiration was the living spring of their endeavor. In the proportions and harmonic measures of their cathedrals and abbey churches they strove to express ideals of truth. The more closely we study their masterpieces of beauty, the better shall we understand why and how they laid out their work with such happy results.

The cathedral plan comprises a nave, aisles, transepts and choir, sometimes called the chancel or sanctuary; the general form of this combination is the Latin cross. A notable feature of the design in English cathedrals is the great difference in the length and breadth of the nave, the former being three, four, or even six times the latter. The reason of this may be found in the customary form of the worship for which they were built; the nave could receive several thousand people, while the aisles were reserved for the great choral processions which filled the lofty arches with jubilant praise. The supreme purpose of the architectural design being worship, the massive colonnades of stone between nave and aisles did not impair the musical or religious effect of the service. The sacramental solemnities were administered in the choir or chancel, whence the singing, toned and softened by distance, fell upon the great congregation like voices from the arch of heaven. The Comacine architects had lofty ideals and knew how to clothe them in realistic forms.

The money required for the erection of these edifices in the eleventh and twelfth centuries was to a large extent supplied by loans from the Hebrew merchants who flocked into England after the Norman conquest, and became the capitalists of the country. They had their quarters, "Jewries," in every considerable town, with a local government quite independent of town authorities, subject however to the king as his vassals. One of the wealthiest of their settlements was in the very heart of Oxford, where they erected large houses of stone. Great industrial activity sprang up; and no doubt the abundance of substantial buildings attracted teachers and scholars; educational enterprise flourished, and Oxford rose to the level of foreign universities.

A brief analysis of the cathedral naves and aisles will suffice to show the numeric ideals on which the Comacines planned their designs. The breadth of naves is from thirty to fifty feet; that of the aisles is from fifteen to twenty feet; the pillars of the arcades between nave and aisles are set at intervals of eighteen to twenty-five feet; the whole breadth comprises two squares for the nave and one square for each aisle; thus the arcades stand midway between the outer walls and the central line of the nave; sometimes, however, they are placed aside from the usual midway position but not enough to affect the perspective relation of length and breadth. This arrangement secures such a happy balancing of great magnitudes that on first entering the edifice its grandeur is not appreciated.

The ideal plan of nave and aisles being for breadth four squares, it is for length four, six, eight, ten,

twelve and even fourteen squares. To this class belong Wells, Lincoln, Canterbury, York, Rochester, Lichfield, Gloucester, Durham, Worcester, Exeter, Winchester, Salisbury, Ely, Peterborough and Norwich, to which we may add Westminster Abbey built in the eleventh and twelfth centuries, when the Comacine spirit was still dominant in English ecclesiastical architecture.

Now the religious concept of the Comacine architects, — combining as it did the mystic symbolisms of

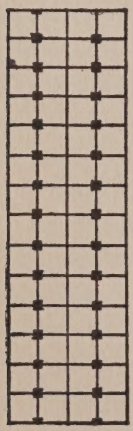


FIG. 21.
CATHEDRAL.

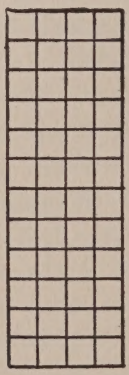


FIG. 22.
TEMPLE AND TABERNACLE.

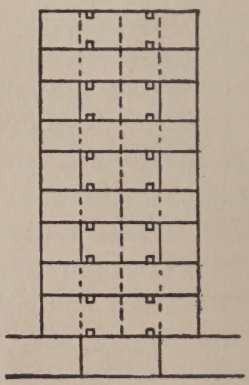


FIG. 23.
EZEKIEL'S GATEWAY.

the Christian faith and the persistent use of geometric forms, — may have originated in the well known conjunction of ideal squares comprised in the plans of Hebrew architecture; these ideal squares prescribed in cubit measures were in harmony with their religious appointments and full of symbolic meaning, and by measure spake the language of Hebrew faith. Were

the Comacines inspired to write Christian truth and reproduce ideals of God's workmanship, as the Hebrew prophets wrote their inspirations in words and numeric symbols? The question may be partly answered by reference to the actual breadth and length of nave and aisles in their edifices; if the mystic tracing is found here, we may easily believe that it pervaded the whole fabric; that the Comacine concept of a Christian temple for the worship of God did not fall short of a spiritual idealism closely akin to that which belonged to the sacred edifices of the sons of Abraham.

A favorite form of symbolism in Comacine carving was a single interlacing thread or strand covering an entire panel, without beginning or end, and, like the circle, a symbol of eternity. Among very ancient artists the pentagonal star inscribed in a circle was also a single line traced without beginning or end. Now this symbol is identified with the measure of the squares that determined the form and proportions of the cathedral plans; it may therefore be called the geometric fountain of Comacine designs. Thus one-fifth of the circle 360° is 72°, which is the number of feet in the breadth of Canterbury, Exeter, Bristol and Westminster. The circumference of a circle is 21600′, its fifth part is 4320′, and the measures of 432 inches and one-half of 432 appear in one-fourth of the squares that form the naves and aisles of the twenty-two edifices here given in detail. The sum of the digits in these numbers is 9, the numeric symbol of brotherhood. The product of 2, sonship, 12, covenant, and 9, brotherhood, is 216. The number 432 appears in the Hebrew log,

the measure of oil for the consecration of the High Priest, the log being 43.2 digits. The circumference of a circle is 1296000″ or 1000 times 6×6^3; 216 is 6^3, and 432 is one-fifth of 2160; thus the numbers 3, 5, 6 and 12, which are so conspicuous in Hebrew architecture, are identified with the cathedral ideals of the Comacine artists. The following table shows the probable sources from which the Magistri Comacini derived their unit squares:

First, Circular or geometric units.

The number of degrees in a circle . . .	360
" " minutes " "	21600
" " seconds " "	1296000
" " inches in the Hebrew cubit, and the radius of a circle whose circumference is 129.6 inches	20.625
The ratio of circumference to the diameter of a circle	3.1416
The ratio of inscribed square to the diameter of a circle	.7071
The ratio of the square of equal perimeter to the diameter of a circle	.7854
The ratio of a square to the diameter of a circle of equal area	.8862

Second, Time units.

The number of minutes in one hour . . .	60
" " hours in one day	24
" " minutes in one day . . .	1440
" " days in one month . . .	30
" " days in one year	365
" " " " " symbolic . .	360

The number of days in one year equinoctial . .	365.24
" " sidereal days in one year . .	366.25

Third, Sacred units.

The numeric form of H V H	565
" " " J H V	1056
" " " J H	105

The diameter of a circle being 565, the square of equal area is 500, which is the cubit measure of Ezekiel's city; and 10 times 1056 inches equals 512 cubits, which is the outside measure of the wall surrounding the city. The Most Holy in Solomon's temple and in Ezekiel's city is 20 cubits, that is integrally the square inscribed in a circle whose diameter is 5 times 5.65 cubits.

THE SQUARES IN THE FLOOR PLANS.

The squares comprised in the floor plan of nave and aisles are here given in inches. Column A, date of erection; B, number of bays; C, breadth of nave squares; D, length of nave squares, and span of arches; E, breadth of aisles; F, edifices in which a uniform square prevails in both nave and aisles:

	A	B	C	D	D	E	
Westminster Ab.	1043	8	216 — 216	216 — 216			F
Winchester	1070	10	258 — 258	258 — 258			F
Rochester	1074	8	196 — 196	196 — 196			F
Lincoln	1075	8	264 — 274	274 — 216			
Ely	1081	12	234 — 234	234 — 234			F
Worcester	1084	8	216 — 234	234 — 252			
Canterbury	1093	8	195 — 237	237 — 237			

	A	B	C	D	D	E	
Durham	1093	8	240 —	300	300 —	240	
Hereford	11th Cent.	6	240 —	219	219 —	204	
Norwich	1096	14	218 —	218	218 —	218	F
Exeter	1112	8	222 —	206	206 —	206	
Peterborough	1117	12	266 —	258	258 —	210	
Wells	1135	8	222 —	180	180 —	180	
Ripon	1154	6	318 —	219	219 —	204	
Chichester	12th Cent.	4	216 —	220	220 —	192	
Lichfield	1200	8	198 —	198	198 —	198	F
Salisbury	1220	10	234 —	234	234 —	234	F
York	1220	8	318 —	318	318 —	318	F
Chester	13th Cent.	6	240 —	234	234 —	207	
Bristol	1306	6	216 —	259	259 —	216	
Gloucester	1540	8	247 —	247	247 —	247	F
St. Paul's	1685	4	306 —	306	306 —	306	F

The symbolic ideals comprised in the squares:

A year symbol,	one-half of 360 days is	180
" "	six times 36.5 days is	219
" "	.8862 times 360 days is	318
" "	.7071 times 365 days is	258
A day "	one-sixth of 1440 minutes is . . .	240
Geometric "	one-sixteenth of 1000 Pi is . . .	196
" "	.7071 times 1000 Pi is	222
" "	one-hundredth of 21600 . . .	216
" "	radius of circumference 1296 is . .	206
" "	21.6 Hebrew spans of 10.95 inches is .	237
" "	216 divided by .7854 is	275
JaH "	one-fifth of 1050 is	210
J H V "	one-fourth of 1056 is	264
" "	.8862 times 264 is	234
" "	.7854 times 264 is	207
H V H "	.8862 times 6 times 56.5 is . . .	300
" "	.7854 times 5 times 56.5 is . . .	222

The symbolic interpretation, integrally, of the measures in the foregoing table of cathedral squares is here given:

TIME SYMBOLS.

Wells	One-half of 360 days	180
York	Square equal to area of circle, 360 diameter	318
Winchester	Square inscribed in circle, 365 diameter	258
Durham	One-sixth of the number of minutes in one day	240
Ripon	One-fifth of a three year cycle, 1095 days	219
Gloucester	One-fifth of a diameter of circle equal in area to a three year square, 1095 days, or 12 cubits	247
Canterbury	One-thousandth of a three year cycle, 1095, taken 216 times . . .	237

GEOMETRIC SYMBOLS.

Rochester	One-sixteenth of 1000 Pi . . .	196
Wells	Square inscribed in circle of 100 Pi diameter	222
St. Paul's	Square inscribed in circle one-third, 1296 diameter	306
Westminster	One-sixth of 1296	216
Ripon	Circumference of circle, diameter, one-half of 129.6	204
Exeter	Radius of circumference, 1296, or 10 cubits	206
Chichester	Square whose area equals circle of diameter, 216	192
Lincoln	Diameter of circle equal in perimeter to square, 216	275
Bristol	One-fifth of 1296	259
Bristol	One-sixth of 1296	216

JaH, J H V, H V H SYMBOLS.

Peterborough	One-fifth of JaH cycle, 1050 . .	210
Norwich	J H V, 10.56 cubits of 20.625 inches .	218
Lincoln	One-fourth of J H V cycle, 1056 . .	264
Ely	Square whose area equals the circle of one-fourth J H V, 1056 diameter .	234
Chester	Square equal in perimeter to circle of one-fourth J H V, 1056 diameter .	207
Durham	Square whose area equals circle of 6 times 56.5, H V H diameter . . .	300
Wells	Square equal in perimeter circle of 5 times 56.5 diameter	222
Lichfield	The short cubit, 17.52 inches, taken two times H V H, or 11.3 times . .	198

Many of these units of measure may have been used and reverenced as traditions of more ancient monumental work. But whatever may have been their source it is obvious that geometric ideals were followed in the cathedral plans, thus: .7071 appears as a factor in the measures of Winchester, Worcester, Wells, Ely, Salisbury, Hereford, Ripon and St. Paul's; .8862 appears as a factor in Chichester, York and Chester. The circular unit 216, the cubit unit 20.625, and the mystic units, 144, 1056 and 565, appear in one-third of the whole. In Lincoln a circular unit appears in the aisles, a time unit in the arcades, and a mystic unit in the squares of the nave. In Norwich all the measures are comprised in the mystic unit 1056. Time units suffice for the measures of Durham, and a geometric unit for those of Worcester. Many of the squares are multiples of 5 or 6 inches. It is certain that great reverence was an-

ciently given to the numerals 5 and 6, the symbols of authority and time; and it does not seem possible that the Comacine artists were ignorant or regardless of the architectural value and significance of these numerals which were inherited from ancient religious art and are so conspicuous in nature.

To many who are not accustomed to look upon architectural designs beyond the horizon of mercenary comfort and utility, such ideals of numeric harmony make no appeal and awake in them no interest. Like people who enjoy the marvel of a musical symphony they take no account of what it has cost the composer, the director, the performers, the instrument makers and the architect to attain the perfect result. The omission of the numerical factor in any part of this complicated structure would ensure a failure. It is a wonderful product of human skill, inspired throughout with profound and ceaseless reverence for Nature's ideal of harmony, the human and the Divine working together to realize that which is beyond the reach of individual effort.

I may say that if numeric symbolism is clearly traceable in the plans of the English cathedrals, we might justly look for it in their superstructures. Some confirmation of this aspect of ecclesiastical art is the Church of St. Elizabeth, Marburg, Germany, a fourteenth century edifice. "Its fundamental square is 216 by 216 inches. The nave is 2 squares broad; the interior length of the building, including doorway, is 12 squares; the aisles are each 1 square broad; the height of the vaulting is 4 squares; the height of the gable is 6

squares; the external length of the transepts, 8 squares; the whole external length is 13 squares, and the height of the tower is 15 squares. In many structures such a fundamental unit does exist." (*Handbook of Architectural Styles*, by A. Rosengarten.) In these measures of St. Elizabeth, 216 is 5 times 43.2, the Hebrew symbols of authority and consecration. The nave being 2 squares broad is the symbol of sonship and consecrated authority. The interior length, 12 squares, is the symbol of the covenant with consecrated authority, or 12 is 4 times 3, household of God. The height of vaulting, 4 squares, symbolizes the temple of consecrated authority; the gable, 6 squares, is the light of consecrated authority; the transepts, 8 squares, are the symbol of life, 8; the external length, by 13 squares, is the numeric form of E L, the Almighty, and the tower, by 15 squares, represents JaH. We cannot think this a series of accidental coincidences, nor can we believe that earnest men of faith would toy in work that was to be consecrated to God for the illumination and life of His people.

In adopting the numerical and geometric basis of natural harmony in conjunction with cycles of time and the mystic numbers 565, 1056 and 144, the cathedral builders brought forth masterpieces of architecture which, for beauty, strength, harmony, and an uplifting inspiration to faith, remain unsurpassed. The handwriting of the Comacine spirit appears in the cathedral lines as clear and intelligible as the marks of racial descent which a man bears in his face and speech. That spirit wrought in faith and love, and to-day the

pitiful ruins of the homes that gave it shelter are marvels of ideal symmetry. Though roofless and neglected, the doorways, windows and arcades of abbey churches hold fast the lines on which they were built seven or eight hundred years ago, mutely looking upon the desolation round about them with a calm and hopeful aspect that says "I believe in the resurrection of the dead."

The pointed arch being a characteristic feature of Comacine work, the ideal edifice depended much upon this for its best realization; therefore the greatest care was taken to give the arch its finest proportions. There is good ground for the belief that in their ideal arches as well as in their floor plans the Comacine artists followed geometric lines.

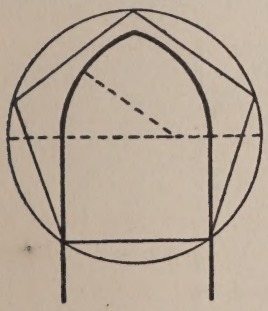


FIG. 24.

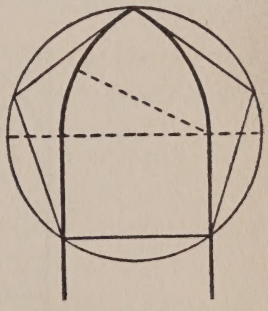


FIG. 25.

The cuts herewith [Nos. 24 to 27] show arches derived from the pentagon that coincide with the curvavature of the arcades, windows and doorways of many cathedrals and abbey churches.

In Fig. 24 the span of the arch equals the side of the pentagon, and its height equals the radius of the

inscribed circle. In Fig. 25 the span of the arch equals the side of the pentagon, and its height equals the radius of the circumscribing circle. In Fig. 26 the

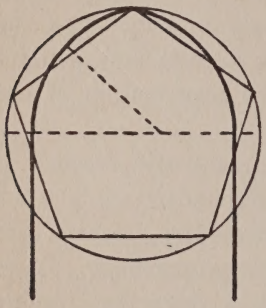


FIG. 26.

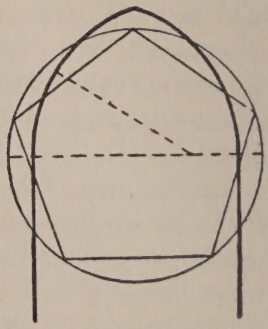


FIG. 27.

span equals the diameter of the inscribed circle, and the height equals the radius of the circumscribing circle.

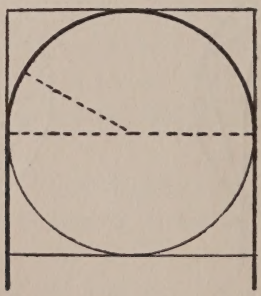


FIG. 28.

In Fig. 27 the span equals the diameter of the inscribed circle, and the height equals the side of the pentagon.

In the floor plans of the cathedrals the simplest unit was a perfect square, as in Winchester and Rochester, but other forms were in use based on the relation of

the diameter of a circle to the side of a square of equal area, or of equal perimeter, or that of the inscribed square or inscribed equilateral triangle. In like manner for arches, the radius of a circle being the height of the arch, and the diameter being the span, we have the Norman arch (Fig. 28). Next to this but of sharper

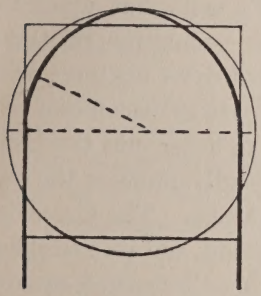


FIG. 29.

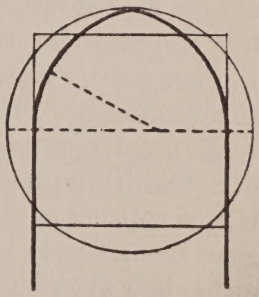


FIG. 30.

pitch is the arch (Fig. 29) whose height is the radius and its span is the side of a square of equal area. A

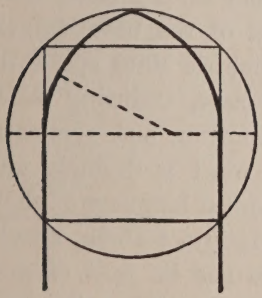


FIG. 31.

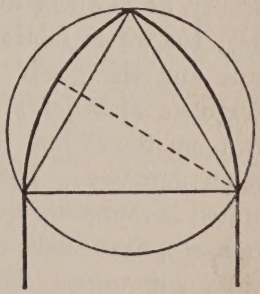


FIG. 32.

still sharper pitch (Fig. 30) is the arch whose height is the radius and its span is the side of a square of equal perimeter. Sharper yet is the arch (Fig. 31) whose

height is the radius and its span the side of the inscribed square; but sharpest of all is the arch whose height and span are determined by the inscribed equilateral triangle (Fig. 32); beyond this the pointed arch loses both in grace and dignity.

Under Comacine treatment the beauty of an arch did not depend upon the builder's taste, but upon the law of proportion that pervades geometric relations. In these unique creations the artist drew his lines with supreme delight. The arched doorway becomes a persuasive and uplifting invitation to enter into the home of righteousness; the windows joyfully embrace the beneficent radiance of the King of kings. The Comacine spirit drank deeply of this inspiration, and its matchless arches bear witness to a lofty faith. Circles and squares stand erect, bearing a crown of glory; straight and curved lines unite in a restful concord that is above criticism; lofty arcades lift up others born of their beauty, as mothers lift their babes for a priestly blessing; the whole fabric is an ideal of the beautiful, the true and the good. Thus geometric lines speak the language of belief, strong, passionate, enduring belief. In them the eternal laws of proportion and symmetry reign supreme. The cycle of what is divinely generated is reproduced in the numerical language of choir, transept, nave, aisle, doorway, window, column, arcade, gable and tower. Every feature has its unit of measure, its mystic symbolism. It is the life of the cathedral builder to read these things and understand what the old masters thought under the inspiration of heaven-born faith. "Art thus becomes the moment's

repose of religion, or the instant when love stops, half unconscious, on her pilgrimage in search of the Infinite, lingering to gaze on the accomplished past and dimly seen future — a dreamy suggestion, nothing more fixed, but a suggestion of the spirit, nothing less noble." (*Okakura, Ideals of the East.*)

The following notes are from *Cathedral Builders*, by Leader Scott:

a. Prof. Merzario, on the authority of ancient MSS., says that architects and builders sent abroad were Liberi Muratori (masons free to come and go), a title under which Comacines were described (p. 143).

b. Comacines settled with St. Augustine in Canterbury (pp. 150, 160).

c. Rotharis, a Lombard king, issued an edict Nov. 22, 643, concerning Muratori. The title of Art. 143 was "Of the Magistri Comacini and their Colleagues." "If the Comacine master with his colleagues shall have contracted to build or restore a house," etc. In Art. 144 it reads: "If any person has engaged or hired one or more of the Comacine masters to design a work .... and it should happen that some Comacine should be killed, the owner of the house is not considered responsible" (pp. 6, 4).

d. Paulinus was sent to St. Augustine, and he was known as a Magister. Monks of the West were identified or connected with the Comacines (pp. 145, 152).

GRECIAN TEMPLES.

In ideal simplicity, purity and severe proportions Greek architecture is supreme. Like the poetry and other art products of that brilliant race it is a true exhibit of native intelligence and love of the beautiful.

Liberty to think and act was the Greek's fundamental passion. He despised inefficiency as he exalted personal ability. The stimulant that urged him to do his best was the national spirit. He was passionately fond of geometric lines and forms. His art ideals were developed and enriched by nature-study. He lived in an ideal world out of which arose his beautiful creations. He was democratic and public spirited. His ideals reached their climax in temples and human statues. As early as the sixth or seventh century, B. C., he had given his country many edifices, which in the latter half of the sixth century were mostly destroyed by the Persian invaders, when he lost his liberty; but in the beginning of the fifth century, B. C., by Roman help the Persians were driven out, his liberty was restored and his art revived. The golden age began and temples were rebuilt with greater enthusiasm than in former days. The symbolic ideals of Egypt and the East found a fruitful resting place in the Greek soul, and ideal beauty in architecture became enriched with ideal life.

The Greek being a thought builder and thought analyzer, held the harmonies of nature and geometry in a happy balance; ideal symmetry in his art was one result; another, that entered into his temple creations, was a system of mensuration that bore in every feature a likeness of nature and geometry. The equinoctial, sidereal and symbolic year measures, 365.25, 366.25 and 360, were familiar ideals of time. The mean of these numberings is 364, integrally. The ancient number 129600 was his all-encompassing standard, while 3 was

his numeric symbol of perfection, and its cube, 27, the containment of perfection. His ideal of a system of measures appears to have been rooted in these numbers. Thus 129600 divided by 270 is 480, and 364 divided by 480 is .76, which is the inch measure of the Greek digit. How well this agrees with the historical evidence of Grecian measures of length can be seen by the following table:

364 ÷ 480	=	.76	=	1 digit			
		.76	=	1 "	=	$\frac{1}{16}$	of a Greek foot
364 ÷ 240	=	1.52					
		1.52	=	2 digits	=	$\frac{1}{8}$	" "
364 ÷ 120	=	3.03					
		3.03	=	4 "	=	$\frac{1}{4}$	" "
364 ÷ 60	=	6.066					
		6.07	=	8 "	=	$\frac{1}{2}$	" "
364 ÷ 48	=	7.58					
		7.59	=	10 "	=	1 likas	
364 ÷ 43.2	=	8.43					
		8.43	=	11 "	=	1 orthodoron	
364 ÷ 40	=	9.10					
		9.12	=	12 "	=	1 spithame	
364 ÷ 30	=	12.133					
		12.14	=	16 "	=	1 pous, Greek foot	
364 ÷ 27	=	13.48					
		13.65	=	18 "	=	1 pugme	
364 ÷ 24	=	15.17					
		15.17	=	20 "	=	1 pugon	
364 ÷ 20	=	18.20					
		18.21	=	24 "	=	1 pachus	
364 ÷ 12	=	30.33					
		30.35	=	40 "	=	1 bema	

$364 \div 5 = 72.80$

$72.84 =$ 96 digits $= 1$ orguia

$364 \div 3 = 121.33$

$121.33 = 160$ " $= 1$ dekapous

The series continues up to 7200 digits, and all the divisors or multipliers of 364 are factors of 129600. It is in view of this ideal harmony in the Greek's system of measures that we examine the geometric proportions and measurements of his temple plans.

ZEUS OLYMPUS, AGRIGENTUM, B. C. 480.

Agrigentum was one of many cities created by Greek colonists in Sicily and southern Italy before the fifth century B. C. At the close of that century its municipal rank was next to Syracuse. Thoroughly Grecian in spirit and life, it had its own independent government. In its religious habit and thought Zeus was the supreme ideal of the divine personification of supremacy in the forces of nature.

The plan of a Greek temple was not a combination of squares like Hebrew designs, but an oblong rectangle. The length of Zeus Olympus at Agrigentum was 3944 inches, and the breadth was 1710 inches. Now, the Olympian races were instituted 775 B. C., and continued to be celebrated every fourth year through many centuries. This cycle of four years, comprising 1461 days, was called an Olympiad. These games were designed to foster and represent the physical perfection of Grecian culture. In numeric symbolism 3, or 27, the cube of 3, stood for ideal perfection. The combi-

nation of an Olympiad, 1461 days, with the numeric symbol of perfection, 27, gives 1461 × 27 = 39447. One-tenth of this number, by inches, is 3944, the length of the temple Zeus Olympus. The breadth of the temple being 1710 inches, it comprised two rectangles 1710 by 1972 (Fig. 33). The ratio of these numbers is very nearly as 1000 to 1150; the circumference of a circle whose diameter is 366, the number of days in every fourth year of the calendar, is 1150. It may be observed here that one-tenth of the product 4 × 27 × 365.24 is 3944.5, the length of the temple; also that the length is to the breadth as the breadth is to height of columns.

FIG. 36.

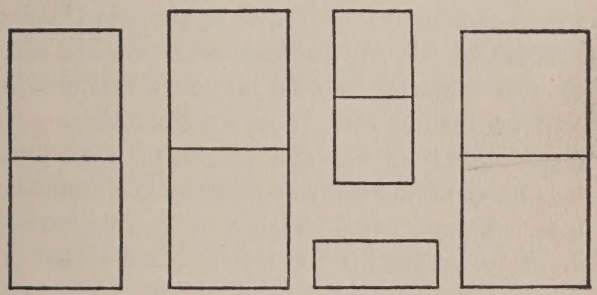


FIG. 33. FIG. 34. FIG. 35. FIG. 37.

TEMPLE OF JUPITER AT OLYMPIA, ATHENS, B. C. 440.

This temple was erected in the golden age of Greek art, when the Athenians, recovering from the desolations they had suffered by the Persian invasion, were enjoying the friendship of Rome. It was the chief of the temples at Olympia. The unit of its measurement appears to have been the Roman foot, 11.65 inches.

The length of the edifice being 4248 inches, equal to 365.25 Roman feet, and the breadth being 1848 inches, it comprised two rectangles 1848 by 2124 (Fig. 34); the ratio of these numbers is as 1000 to 1150, the same as in the older temple of Zeus at Agrigentum.

TEMPLE OF JUNO, OLYMPIA, ATHENS.

Juno, wife of Jupiter, was a personification of atmospheric activity on which vegetation depends for reproduction and growth; hence the ideal Juno was revered as the goddess of fertility. The plan of this temple is a rectangle 774 by 2016 inches (Fig. 35). The length is equal to 166.1 Greek feet of 12.134 and the breadth is 63.8 Greek feet. Now the winter season from the autumnal to the vernal equinox is 180.6 days. The radius of the square inscribed in a circle of 180.6 Greek feet diameter is 63.8 Greek feet, which is the breadth of the temple. The summer, the season of fertility, is 184.6 days. The height of a Pi pyramid is nine-tenths of the radius of the circle circumscribing its base. Taking 184.6 Greek feet for this radius, the height of its pyramid is 166.1 Greek feet, which is the length of the temple. The pyramidal form, like the taper of evergreens, may fitly symbolize natural fertility. Also 166 is one-half the circumference of a circle whose diameter is 105.6.

TEMPLE OF MINERVA, THE PARTHENON, B. C. 454.

The Parthenon, virgin goddess, standing on the Acropolis and looking down upon the city of Athens, was the most beautiful of all edifices of its kind, the acme

of Greek architecture in the splendid age of Pericles. Minerva, Jupiter born, was a personification of wisdom, skill and all liberal sciences. Her Greek name Athena gave name to the city where ideal wisdom and skill were most honored. The Parthenon was the Greek's architectural ideal of wisdom and skill. In measures of the Greek foot 12.134 inches, it appears to have been associated with the stars and the ancient Egyptian number 1056 which was the Egyptian measure of 1″ of longitude in inches at Memphis. The breadth of the Parthenon (Fig. 36) 1224 inches, equal to 100.8 Greek feet, is the diameter of a circle whose circumference is 3 times 105.6 Greek feet. The half length is 1368 inches equal to 1296 × 1.056. The length, 2736 inches, is the side of a square inscribed in a circle whose diameter is 10.56 times the number of sidereal days in the sidereal year. In proportions the length is to the breadth as the breadth is to the height of the eaves above the base, the same as the proportions of length, breadth and columns in Zeus Olympus.

TEMPLE OF DIANA, EPHESUS, B. C. 530.

Diana, daughter of Jupiter, was a personification of the moon and the chase. Like the moon she had no consort, a perpetual virgin, and sped over the hills like the moon in search of her game. Diana of Ephesus was the last of three Diana temples erected on the same ground. It comprised two rectangles, 166.6 by 169.35 Greek feet (Fig. 37). A race course 5000 feet in length divided by 30, the number of days in a month, gives 166.7 Greek feet, and if it be divided by 29.53,

the number of days in a lunation, it gives 169.34 Greek feet. The ratio of the rectangle-measures comprised in the plan of the temple is the ratio of the days in the lunar month to the days in the calendar months, 29.53 to 30.

Idealism in Grecian temples was democratic, for the public eye. The beautiful colonnades surrounded the walls of the shrine, whereas in Egyptian temples, the wonderful colonnades were hid from the public by solid walls. To the Egyptian mind temple symbolism was a religious mystery in the keeping of the priests. To the Greek mind it was an open display of the beauty and harmony of nature's order and perfection, in a period when geometry and numeric symbolism had a conspicuous place in the lofty speculations of Greek thought.

ROMAN TEMPLES — THE PANTHEON, ROTUNDA, A. D. 123.

This temple (Fig. 38) appears to have been designed to represent the dome of the stars. In form it touches the top, base and sides of a cube. The lower half of the interior is cylindrical, with a diameter of 1710 inches; the upper half is the hemisphere inscribed in the cube. The radius of the dome is 73.25 Roman feet, that is, one-fifth of the number of sidereal days, 366.25 in a sidereal year. It has five rows of panels round about, each row containing 28 panels. It is lighted through a circular opening in the centre of the dome 324 inches in diameter, one-fourth of 1296. The circumference of this opening is 58.13 Roman cubits,

equivalent to the radius of a circle whose circumference is 365.24 Roman cubits of 17.52 inches. The ideal of this temple's form and dimensions appears to embody in geometrical lines both sidereal and equinoctial measures of time. The original approach was by seven steps. It has an imposing porch and is now the Church of St. Maria, Rotunda.

MAISON CARRÉE, NISMES, A. D. 138.

The half-length of this temple (Fig. 39) is 597 inches, the diameter of a circle whose circumference is one-fourth of 365 Egyptian cubits of 20.566 inches. The breadth of the temple, 418 inches, is the circumference of a circle whose diameter is 5 times 36.525 digits of .728 inch.

FIG. 38.

FIG. 39.

FIG. 40.

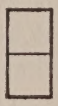


FIG. 41.

DIANA, NISMES.

The length of this temple (Fig. 40) is 1128 inches, the diameter of a circle whose circumference is one-twelfth of 3652.5 Roman feet. The breadth is 70 Roman feet.

SATURN, 284 A. D.

This temple (Fig. 41) comprises two rectangles, 428 by 668 inches. Taking the Roman foot at 11.66, equal to 16 digits of .729 inch, and the sidereal year of 366.25

days at one-tenth of the Roman foot for a day, we have $366.25 \times 1.166 = 427$ inches, or one-half the length of the temple. With the same day unit of one-tenth of the Roman foot the year of 365 days as diameter of a circle gives for circumference 1337 inches, equal to twice the breadth of the temple.

Ideals in later Roman architecture may be regarded as remnants or imitations of traditional lines that had ceased to have a symbolic value. Under the materialistic rule of the Caesars the mystic spirit grew weary in thought and action. But in later centuries, under the inspiration of Christian symbolism, it rose again to new life and crowned the old colonnade ideals of Egypt and Greece with arches of surpassing grace. In the brief space of two hundred and fifty years the Christian cathedral attained its perfection. It was a notable era of monumental work that sprang out of faith in the mystery of things unseen. Eras of temple building, like eras of inspiration in literature, mark the world's history from the beginning; each has its day and mission; each opens a fresh spring to enrich the great current of civilization. It is the law of progress, that belongs to religions, governments and industrial economies. To understand an era of Divine fertility, whose splendor we dimly see in the pitiful ruins half buried in the sand and still melting away through neglect, we should discern not only the masterfulness of the work done but the spirit that possessed its generators and the ideals that inspired their energy. Each era, of

short or long duration, was not the mere development of an ancient family ideal, but a new contribution towards the building up of an ideal humanity; so the great eras of art, religion and history, like the eras of nature, are tokens of the purpose of Him to whom all things belong and in whom all things consist.

The coincidences we have briefly noted in this chapter touch nearly two thousand years of European history. They belong to edifices designed by men of the highest culture, profoundly in love with Nature's order and beauty. The material fabrics they created were the fruitage of ideals found by close observation of Nature's activity and grafted into the architectural life of the artist; this seems to be a rational explanation of his superb work. To him the lines of his temple were the symbolic expression of great facts in Nature, which he saw could be none other than tracings of Divine wisdom and love. He felt that he was laying hold of Divine ideals of beauty and harmony, and moving in the companionship of the Deity. Every fresh discovery in Nature's treasury of symmetrical relations was a stimulant to further search after the Divine. It was a marvellous life of inspiration; so he lived and so he wrought for the life and edification of his own people and of the ages to follow; and to-day, after the lapse of many centuries, we stand with heads uncovered in the presence of mutilated remnants of his work, while the mystic wand by which he gave his ideals a living form lies buried in the ruins.

CHAPTER VIII.

ANCIENT MONUMENTS.

THE relics of ancient monumental work are widely scattered, both hemispheres having a clear title to the antiques. Many observers regard them as mere curiosities, of little or no practical importance. To the student of human life they are revelations of what great men thought and did, even beyond the dawn of modern or ancient history. The stone walls speak, though we know not what they say. The tool marks, the arrangement, the grouping and the form of halls, corridors, enclosures, moats and embankments, denote skillful workmanship in the midst of a well defined life. The student of archaeology investigates the relics to discover the scope and purpose of that life, and its habits of thought. The longer the interval between his own day and that of the ruins traversed by his eye, the deeper is his interest and the keener his research. A difference in the form of the inscriptions on a granite column signifies the lapse of centuries. Every bit of antique becomes valuable. With devout care he picks up the cast-off rubbish of an old, deserted street, and detects the mark of a thousand years agone. To-day our museums derive their chief value from such gatherings. In the court of modern criticism they are witnesses so potent that not seldom do they overthrow our

cherished ideals of the past, whatever our fathers have taught us to believe, and the study of antiquities grows into vital importance.

STONEHENGE.

This notable relic in Salisbury Plains, England, is believed to belong to the fifth century A. D., but its

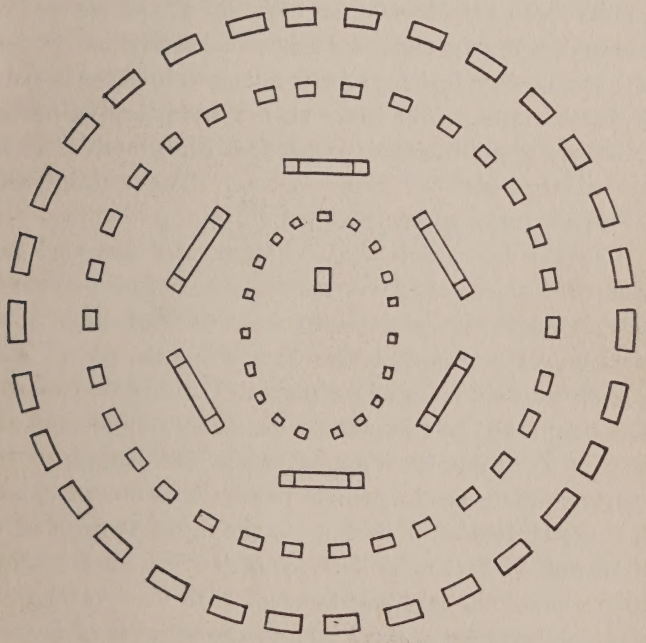


FIG. 42. STONEHENGE.

antiquity is really unknown. It comprises four encompassing columns of stone, the outer two being concentric circles, the inner two concentric ellipses. The whole is enclosed by a moat and embankment; it was in a good state of preservation as late as 1800 A. D.

The diameter of the outer circle is 1163 ± 1 inches, hence the circumference is 3652 inches, the number of days in ten years. It had thirty columns of hewn sandstone on which rested huge stone beams dove-tailed together round about. The inner was set nine feet inside the outer circle and consisted of thirty unhewn pillars of granite five or six feet high. Within this circle was an ellipse comprising twelve columns of sandstone sixteen and twenty-two feet high, which were connected in pairs by stone beams. The inner ellipse comprised nineteen columns of granite five or six feet high, within which was a large slab of blue marble. The arrangement throughout was geometric.

The use for which the structure was designed has been the subject of much speculation. The geometric ideal is based on the circle of 360° divided into thirty sections, or six sections of five columns each, corresponding to six pairs of columns in the enclosed ellipse. The height of the columns of the inner circle is measured by the numbers 5 and 6, while the height of the loftier columns set in pairs is in combinations of 5 and 6, thus, 16 feet = 5 + 6 + 5, the numeric form of H V H, and 22 feet = 5 + 6 + 5 + 6 = one-fourth of 1056 inches, the numeric form of J H V. As the circumference circle is 3652 inches, the number of days in ten years, the thirty columns of the inner circle correspond to the number of days in a month, and the twelve columns of the outer ellipse correspond to the number of months in a year, while the nineteen columns of the inner ellipse correspond to the number of years in the lunar cycle. A religious symbolism may be involved in

the design. The circle of 1296000″ being divided into thirty parts, corresponding to the number of columns of the inner circle, each division is 43200″ which in numeric symbolism signifies full and complete consecration, 100 times 432. Again, the circle 1296000″ equals 21600′ and one-thirtieth of this is 720, which is the diameter of a circle whose circumference is 2260 or 4 times 565, that is, house of God. If it was a Christian structure these numberings may have been derived from the Hebrew symbolism, but the geometric and time numbers date back to the most remote of Egyptian antiquities.

THE ROUND TOWERS.

The Round Towers of Ireland have been notable objects of antiquarian study. They are products of mediaeval or early Christian days. More than one hundred are still existing, though much impaired by time and neglect. Without a single exception they are connected with the remnants of old religious houses, chapels, churches or monasteries, frequently bearing in rudely cut stone the symbols of Christian faith. The earliest of these towers were built in rubble-work, the later in ashlar with cement bond.

They are cylindrical in form, and range from 50 to 100 feet in height, slightly tapering and capped with a conical roof. The circumference at the base is from 40 to 60 feet. The walls are 3 to 5 feet thick, with an internal air shaft 6 to 8 feet in diameter, divided by floors into stories 12 to 18 feet in height. The entrance is by a door 2 or 3 feet wide and 4 to 6 feet

high, set on the floor of the second story. Each story has a small window 8 to 12 inches wide and 12 to 18 inches high; but the upper story just under the conical roof has usually four windows, to face east, west, north and south; some have six or eight windows, and one tower has only a north and south window. The ascent inside was by ladders.

No doubt the tower of a religious house or monastery was for the safe-keeping of its treasures and sacred vessels, but it served as a signal station to call the monks to their routine of life, to warn the community of approaching danger, and to hold a beacon-light at night; it was supplied with a bell and candle. But these towers appear to have served another purpose. Orientation of the windows in the uppermost story was generally secured. They were larger than those below, being two feet wide and about three feet high. From them the monks could be seen at their work in every direction, and any violation of the rules of the Order could be detected; so they were watch-towers as well as keeps and belfries. The watching, however, was not confined to the going out and coming in of the monks. On a round tower in Switzerland, built strictly in accord with the Irish towers, is the following inscription: "Ad universa suspicienda"—*For beholding all things.* The connection between religious observances and astronomical seasons was a notable feature of ancient monastic life. The days of the sun, moon and stars, the hours of the day, the time of the solstices and equinoxes, the constant change of hour in the rising and setting of the stars, and the moment of their tran-

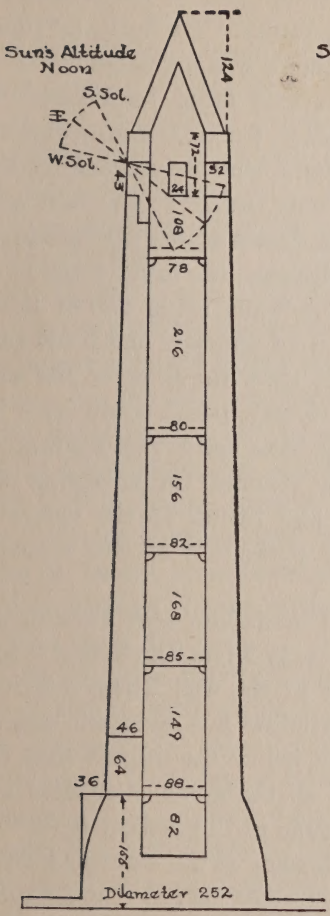


FIG. 43. CLONDALKIN, NEAR DUBLIN.

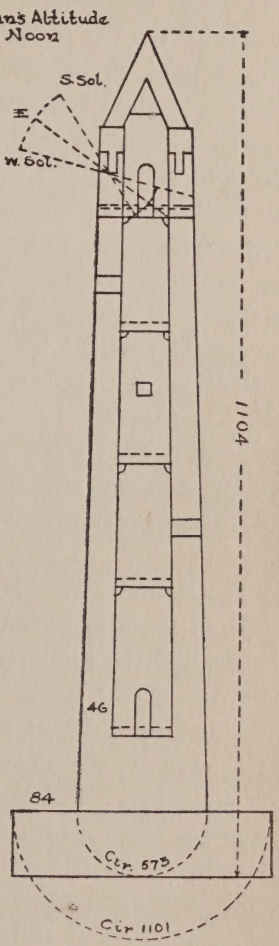


FIG. 44. RATTOO, COUNTY KERRY.

sit at the place of observation, were of permanent interest to the monastic community. By heavenly times and seasons the life of the monk was regulated.

The Round Towers were well fitted for Polaris observations at the north window, for transit observations at the south window, and for noting the moment of the rising and setting of heavenly bodies at the east and west windows. By threads drawn across the openings, like the spider lines in a telescope, the exact position of a star could be noted. The walls being two or three feet thick, the solar shadows of the jam and lintel cast upon the floor within would show the hour of the day and the time of the year. Every month could have its transit floor-mark. In that little cell a vast amount of astronomical data could be secured for enlarging the scope of monastic studies and lifting up the monastic mind to the greatness and perfection of God's sovereignty.

In the Round Tower at Clondalkin, near Dublin, the breadth of the upper window is 2 feet, the height 3 feet 7 inches, and the thickness of the wall 2 feet 8 inches. In the sill of the south window is a step cut out, 18 inches deep and 20 inches below the sill, so that the solar shadow of the lintel at the summer solstice can reach the floor. The latitude of Clondalkin is 53° 21′ N., and the sun's zenith distance at the summer solstice at noonday is 53° 21′–23° 28′=29° 53′, so that the lintel shadow falls upon the floor a little inside the sill and step. The moon at times reaches a higher declination by about 1°, and the lunar shadow of the lintel at the meridional transit clears the sill and step and reaches

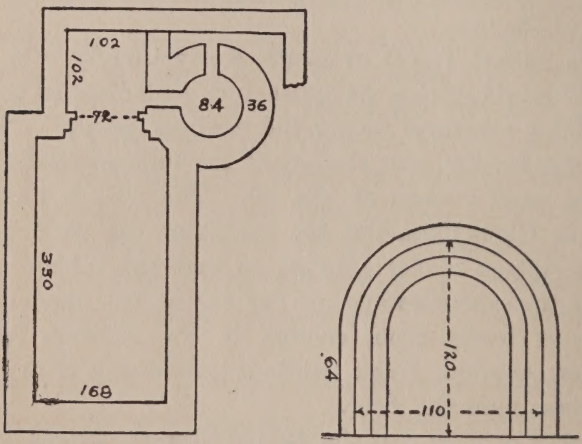
the floor. At the equinoxes the solar shadows of the lintel and sill fall upon the floor and wall opposite, at points equally distant from the junction of floor and wall. At the winter solstice the lintel shadow at noon falls upon the middle of the north window. In like manner the position of the shadows of the east and west windows show the time of the year and the hour of the day.

The Round Tower at Rotto, Kerry County, "is divided into six stories, the upper story containing as usual four large apertures facing the cardinal points." The cut-away for the solar shadow at the summer solstice is in the lintel instead of the sill. The wall is thicker than in Clondalkin, but the height of the window is about sixteen inches greater, so that the shadow has nearly the same clearance of the sill as in Clondalkin. There is barely room enough in the masonry for a wooden window frame without interfering with the shadows upon the floor.

It thus appears that the Round Towers, always built in connection with religious houses, or monasteries, were designed for astronomical observations. In the monastery on High Island Mr. George Petrie, in 1820, saw a granite globe about "twenty inches in diameter;" probably it was just 20.625 inches, for a sphere of this measure being one-half of 129.6 inches in circumference is well suited to celestial draughting.

Some of these towers are connected, in the records, with St. Patrick. For the erection of his churches he had a Lombard artisan skilled in wood and stone, who may have belonged to the guild of Master Builders, of

Istria, Lake Como, a veritable Comacine. Traces of Comacine workmanship are conspicuous in the later monastic buildings. With such competent skill at his command St. Patrick could realize his ideals of proportion and symbolic forms in the construction of towers, churches and oratories. That he had ideals appertaining to these things there can be but little doubt. The



ST. FINGHIN BLONMACNOISE. FIG. 45. CHANCEL ARCH ST. FINGHIN.

churches prior to the ninth century were indeed small internally, the breadth being from ten to thirty feet and the length from fifteen to sixty feet, or more. The walls were from three to five feet thick and twelve to fifteen feet high. The church at Armagh with its immediate adjuncts stood within an enclosure 140 feet in diameter, according to St. Patrick's law, and of a man's height. The circumference of the enclosure was 5280 inches, that is 5 times 1056. This ideal may have been

derived from the measure of the wall round about Ezekiel's symbolic city, which is 10560 inches on every side. St. Patrick's ideal for the length of his churches was 60 feet, or 720 inches, which is the diameter of a circle whose circumference is 4 times 565 inches. The measure of a circle by degrees is 360, and St. Patrick's ideal length is just twice that number in inches. It may also be observed that a circle of 360 units in diameter has a circumference of 1130 units, or 2 times 565. Thus by number St. Patrick's ideal was in accord with astronomical units as well as with the symbolic numbers 1056 and 565.

The chancel of Glendalough was 137 by 186 inches. Its area, 25,482 inches, is almost identical with the area of a circle whose circumference is 565 inches. The depth, 186 inches, is the number of days from the vernal to the autumnal equinox, while the breadth, 137, is one-third the breadth of the Most Holy in Ezekiel's vision. The nave is 312 inches, equal to six times the number of weeks in a year, while the length, 42 feet, is equal to six times the number of days in a week. The spirit of Hebrew mysticism possessed early Christian thinkers, and this, in connection with star observations, may have led them to incorporate such data in the construction of their towers and churches.

OHIO EARTHWORKS.

Along the Ohio river and its branches are the remains of numerous earthworks, of unknown antiquity. In the second quarter of the last century surveys were made by engineers, chiefly Squier and Davis, whose re-

port was published by the Smithsonian Institution in 1848. The geometric form of these works led to much theorizing as to the date and purpose of their construction and of the people by whom they were built. After the lapse of thirty or forty years, a resurvey was made by Cyrus Thomas, assisted by Mr. Middleton; a report of their work was published in 1888 by the Bureau of Ethnology.

Some of these earthworks are located on commanding positions, the walls and ditch round about outside following the irregular contour of the hill-top, as if built for defence; the others on lower ground were laid out in groups of squares and circles; frequently the largest of those comprising a group are connected by a walled passage. The small circular enclosures are one hundred to three hundred feet in diameter, each like the large one having a ditch round about *inside* the wall or embankment. Besides these grouped enclosures there are many circular mounds, some being fifty feet high. Explorations show that the mounds were tombs, but in only one was there a well-preserved skull which could have been the head of a mound-builder. It is a fine specimen and indicates a high race-order.

The engineers declare that these earthworks were laid out with remarkable precision and might be classed with like structures found in Mexico. They also say that to secure the symmetrical construction of squares, circles, octagons and parallelograms of equal areas the builders must have had a standard unit of measure. If that unit could be determined it might be a clue to the ideals which fixed the dimensions of the squares and

circles. As the embankments had suffered from many years of exposure to wind and rain, the mid-line of the top, where the surveys were made, can at best be regarded as only a fair approximation to the original design. The following is a partial list of the measures of enclosures; diameter of circles and sides of squares are given in feet; squares are marked *. Roman numbers denote the plates in the Squier and Davis Report: —

High Bank	XVI	1050, 950*, 250, 300, 300, 300.
Hopkinton	XVII	1050, 950*, 200, 250, 300.
Mound City	XIX	250.
Ross County	XX	1720, 1080*, 800, 375.
Ross County	XXI	1620, 1080*, 800.
Ross County	XXI	1620, 1140*, 800.
Ross County	XXII	210, 240*, 210, 200, 150, 120, 120*, 100.
Ross County	XXIII	250, 200, 210, 150, 150, 130, 130, 110, 110.
Pike County	XXIV	1050, 800*, 300, 206*, 240.
Newark	XXV	1215, 1034.
Montgomery	XXIX	1950, 1150*, 875, 630* by 550*.
Butler	XXX	1200, 760*.
Ross County	XXXII	375, 275, 250, 250, 250, 250, 250, 250, 225, 225, 200, 150.
Ross County	XXXIII	510, 1320* by 1080*.
Ross County	XXXIV	470, 950*, 216.
Ross County	XXXVI	210, 420*.

Ross County, XXI.4. Circle 1620 feet, square 1080 feet. The radius of the circle inscribed in this square is 540 feet = 6480 inches, equal to 5×1296, equal to the circumference of a circle whose diameter is 100 Egyptian cubits or 2062.5 inches. The side of the

square is equal to the circumference of a circle whose diameter is 200 cubits, also 1080 feet = 12,960 inches. The diameter of the circle is equal to the circumference of a circle whose diameter is 300 cubits, also 1620 feet = 19,440 inches = 15 times 1296.

Chillicothe, XX. Circle 1720 feet diameter, equal to 1000 cubits × 18 inches. The side of the square 1080 feet is equal to the circumference of a circle whose diameter is 200 cubits; it is also one-fifth of the circumference of the circle whose diameter is 1720 feet and one-fifth of 21600′, the number of minutes in a circle, that is 4320, which is the symbol of consecration. This square, therefore, may have been the temple of the community that occupied the small circular embankments that were round about it.

Newark. Cyrus Thomas's survey. The diagonal of the octagon is 1718.75 feet = 1000 cubits; the survey is 1714. ± 3. feet. The short diameter of the octagon is 864 cubits, which is $\frac{1}{100}$ of the number of seconds in twenty-four hours. The radius of the inscribed circle is 432 cubits, the numeric symbol of consecration, $\frac{1}{3}$ of 1296. The circumference of the circumscribing circle is $\frac{1}{4}$ of 129600 inches. The diameter of the small circle is 1050 feet, equal to the side of the square inscribed in a circle whose diameter is 864 cubits. Thus the unit of measure by which these earthworks were laid out appears to be the Egyptian cubit, 20.625 inches.

Baum Works. Square 1116.75 feet = 649.7 cubits. Cyrus Thomas's survey. The number of sidereal days in a sidereal year is 366.256. The radius of a circle being 366.256 cubits, the square of equal area is 649.2

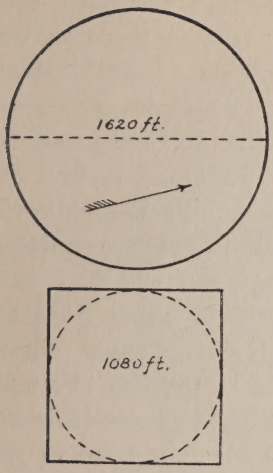


FIG. 46. ROSS CO.

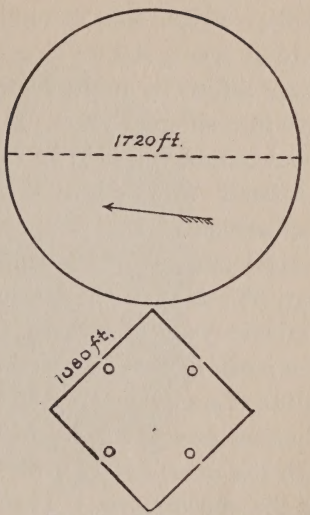


FIG. 47. CHILLICOTHE.

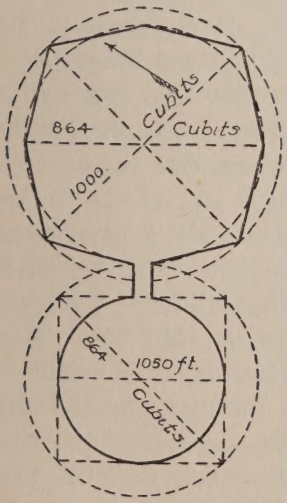


FIG. 48. NEWARK.

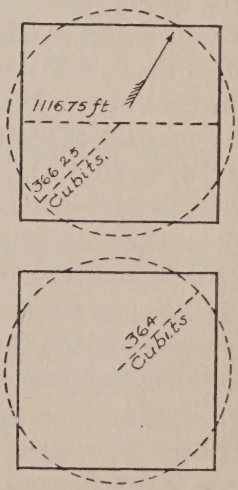


FIG. 49. BAUM.
FIG. 50. LIBERTY.

cubits. From this it appears that the ideal of the builders was a square equal in area to that of a circle whose radius by cubits represents the number of sidereal days in a sidereal year. If so, it probably was a traditional numbering held in reverence by their ancestors.

Liberty Township. Cyrus Thomas's survey. The numberings of the year are 366.256 sidereal days in a sidereal year, 365.242 mean solar days in the equinoctial year, 365 days in the sothic year, and 360 days in the symbolic year of twelve months of thirty days each. The mean of these reckonings is 364.12 days. Now the radius of a circle being 364 cubits, the side of a square of equal area is 1108.8 feet, which is a close coincident with the mean 1107.75 feet of the four sides as given in the survey, viz.: 1110, 1106, 1108, 1103. The ideal of this earthwork appears to be an area representing by its four sides in cubit units the great year measures well known in ancient Egypt and Babylonia.

High Bank, XVI. Circle 1050 feet, diagonal of octagon 1261 feet. The diameter of this circle 1050 feet is the diagonal of a square whose side is 432 cubits, $\frac{1}{3}$ of 1296, or $\frac{1}{2}$ of 864, which is $\frac{1}{100}$ of the number of seconds in 24 hours, and therefore it may represent by cubit measure the mean daylight of 12 hours, 43200 seconds, or the geometric number 1296. The diagonal of the octagon by the survey is 1261 feet. Now the sidereal year is 366.256 sidereal days. The radius of a circle being 366.256 cubits, the diameter is 1259 feet and but little less than the diagonal of the octagon. Therefore the octagon may have been designed to represent by cubit measure the sidereal year.

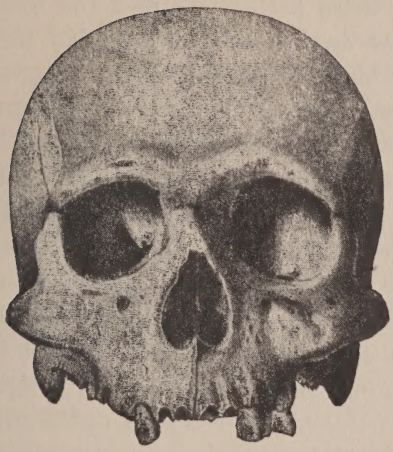


FIG. 51. MOUND BUILDER'S SKULL.

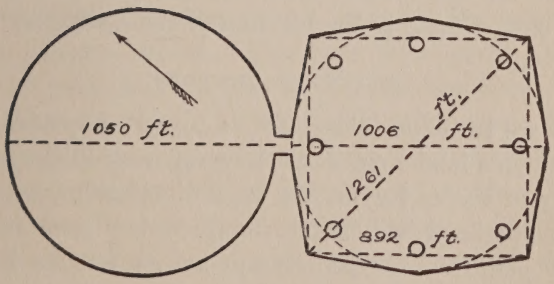


FIG. 52. HIGH BANK.

In the long interval that occurred between the abandonment of these earthworks and the modern survey some changes doubtless took place in their outlines, making the survey at the best only an approximation to the original structures. Nevertheless the persistent exhibit of the Egyptian cubit in connection with year measures, a characteristic of Egyptian and Oriental temples, leads to or confirms the theory that the Ohio mound builders were not primitive savages but a race of no mean ability, which came from Asiatic shores, reached the American coast by Behring sea, followed the isothermal line southward and settled on the banks of the Ohio river; of course holding fast their religious customs and habits of thought. Every one of the circular enclosures, 100 to 300 feet in diameter with an inside ditch to insure a dry floor, may have been the home of a family comprising two or three generations. We cannot doubt they had a high degree of civilization; but so long ago that large trees are now growing on the artificial mounds. It has all disappeared save the imperishable outlines that bear witness to the location of their villages.

EGYPTIAN TEMPLES.

As we turn from these simple forms of symbolic art in our own land to its relics now reposing in the narrow valley of Upper Egypt, the land of splendor, we strive to comprehend the great thought that gave it birth many centuries before Grecian artists felt its inspiration. We do not gaze long ere its marvellous ruins begin to reveal the handwriting of the world's Great Teacher. Ideals of Nature's harmony spring up in

astonishing rapidity. The deeper we penetrate the mystery the more wonderful do the revelations become. In Old Egypt, the land of isolation, a race of superb ability was inspired to give, in ideal workmanship, an object lesson for the world's education. The full fruitage of that inspiration has not been reached, but the mystic lines of inspired life are being traced to-day with loving enthusiasm. As Grecian art lay buried under centuries of Roman supremacy, and then rose again in human thought to an imperishable glory, so the time must come when the splendor of Old Egypt shall again command the world's reverence. The Divine energy symbolically veiled in her venerable halls, statues and colonnades, shall rise up and speak to men of things that never die.

The ancient records of human activity show that the symbolic spirit prevailed in the older civilizations of Egypt and Asia. Religious ideals were represented in the likeness of living forms. The fundamental article of the Egyptian's faith was belief in one merciful, supreme Almighty, from whom emanate the activities of the physical world. To these were given Divine titles: the sun was the god of life, the beneficent god, the god of the Nile. In the earlier religion of Egypt the god-symbols derived from living things were not objects of worship, but of religious veneration. The chief among flowers was the lotus, among animals the bull, among birds the hawk, among creeping things the serpent, among insects the beetle; each had its own sphere of symbolic cult. The activities of Nature were classified in nine groups, called the nine gods; subse-

quent polytheism was the degenerate product of this specialization.

To a large extent the early life of Egypt was a life of ideals formulated by the priests from nature-study. The seasons of the year were carefully observed; as early as 4200 B. C. the equinoctial year was reckoned 365 days. For convenient use it was divided into twelve months of thirty days each, the addition of five days being made at the end of the year. The solstitial point of sunrise was held of great importance; the temples were generally set with a significant astronomical pointing; the axis of Edfu being to the north, while that of Karnak and Ramesseum was towards the sunrise at the winter solstice. The plans of the temples breathe the spirit of symbolism in the arrangement and measure of halls and courts. We may say that the marvellous architecture of Old Egypt was the legitimate fruit of a religious study of nature; but today in its pitiful ruins we behold the issue of a degenerate national life.

Long before the Greek chiseled his supreme likeness of human beauty and strength, Egyptian art was in full bloom; but the earliest form of Egyptian inscriptions was picture-writing, in which no attempt was made to reproduce the human form, but human action was clearly indicated by lines representing head, body, arms and legs. Many conventional figures were used, as the square, circle and cross; it was life in symbolic form. Out of these grew the alphabetic characters of later Egyptian literature. Among people so keenly sensitive to symbolic creations it seems impossible that in great

architectural work the mystic element could have been altogether wanting. The approach to the sacred shrines within the temple enclosure was through a series of courts and halls, while the shrine itself had no opening in roof or wall save the door of entrance. It may not be easy to say how far the symbolic ideal was carried in the plan and superstructure of these temples, but a careful analysis of the existing outlines of courts and halls appears to reveal, by number and by measure, a likeness of the majestic harmony of nature.

The valley of the Nile, about twenty miles wide, is hemmed in by barren uplands on either side, which extend far back into the country. The density of the population required to execute such a vast amount of architectural work as the ruins indicate, must have been extreme. Skilled artists by the hundred were employed on a single temple, and thousands of men were in demand to quarry, transport and place the hundred-ton beams that formed the colonnades. Rameses II carefully chose his architect from the priests, and we may believe that to them the superb temple designs should be ascribed. Similarity of design prevailed in these edifices as clearly as it did in the churches of mediaeval Europe. The ideal of the Egyptian temple comprised a small shrine for the statue of the patron deity; small rooms grouped about it for the work of the establishment; covered halls set with columns thirty to seventy feet high and six to twelve feet in diameter, graven with records in hieroglyphic writing, and a large open court with standing room for ten or twenty thousand people. All this was enclosed by a solid wall

having at the entrance a huge pylon, sometimes more than one hundred feet high and two or three hundred feet broad. The general arrangement does not indicate a place for public worship. Sometimes a record hall was filled with columns, leaving only space enough to pass between them.

As the monarchs strove to surpass one another in building these palaces for royal and national records, the structures grew in beauty and grandeur. The approach to some was through an avenue of sphinxes. What arrests the architectural eye, in passing up this avenue, is not only the massiveness of the great pylon, but the harmony of its proportions. It is indeed a symbol of royal majesty, power and repose; but more than this it is, by its indispensable sun-disc with outspread wings, the emblem of Old Egypt's faith in one supreme and over-brooding Deity, the sovereign and beneficent ruler of Egypt. The spirit of symbolism prevailed from the great pylon entrance, through every court and hall, even to the holy shrine. Nearly all this magnificence is in ruins; the temples that were erected prior to 4000 B. C. have disappeared; destructions and rebuildings have left barely a trace of the original foundations. The reconstructions and extensions were controlled by the priests, in whom symbolic art found a religious protection. Courts, halls and shrines are almost invariably oblong rectangles; sometimes the width of a floor space is one-half its length. Nearly all the temples have an architectural likeness to one another, that indicates a fundamental ideal of proportion and harmony. An inscription found by Mariette reads:

"Great fundamental rule of Denderah, Restoration done by Tahuti-mes III according to what was found in the ancient writing of the time of King Khufu." Hereupon Mariette remarks: "Its origin is literally lost in the night of time." (*Illustrated Egypt:* Davis.)

In illustration of the symbolic cult that prevailed in the remote ages of Egyptian splendor, we shall give some details of four notable temples — Karnak, Ramesseum, Denderah and Edfu.

Egyptian artists were passionately fond of geometric forms and proportions; and therein may lie the "great fundamental rule of Denderah." A right pyramid, having a height of nine units and a square base side of fourteen units, is the simplest and most complete embodiment of geometric harmonies, and comprises the following elements:

Height of pyramid	9
Half-base side 7.068, or integrally . .	7
Half-base diagonal	10
Length of corner slope, arris line . .	13.45
Length of side slope	11.43

Ratios of these numbers appear in the floor plans of the temples. In Karnak the ratio of the sides of the great court is as 9 to 10; that of the sides of the hypostyle is 7 to 13.5. In Ramesseum the ratio of the sides of the court is as 7 to 9; that of the hypostyle as 7 to 9. In Edfu the ratio of the sides of the court is as 7 to 9; the half base of its pylon is to the height as 9 to 10. In Denderah the porch comprises two squares, the hypostyle one square, the shrine two squares. Now

these geometric relations, derived from the form of a right pyramid, and perhaps religiously observed in temple building as an ancient inheritance, do not explain the orientation of the temples nor the dimensions of their halls and courts. The symbolic spirit did not exhaust itself on geometric forms; other ideals entered into the designs. As the temples were erected in honor of the gods, we may anticipate some traces of the god-symbols.

The façade of Denderah comprises three Hathor, sun, columns on either side of the entrance (three is the symbol of Divine perfection or harmony). Within the façade is the porch set with three rows of three columns on either side of the passage; the hypostyle hall has three columns on either side of the passage. In Edfu there are twelve columns on either side of the great court, and five on either side of the entrance; also in the hypostyle hall there are twelve columns, twelve in the pronaos, and twelve in the sanctuary. It was dedicated to the sun; and by its numbering of columns it appears to symbolize the months of the year or the signs of the zodiac. In Ramesseum the columns are grouped in fours and sixes; in Karnak's hypostyle by sixes, sevens and nines. Such regularity cannot easily be thought accidental.

We pass now to the symbolic dimensions of floors, courts, halls, and general plan. The great temple of Karnak is on the eastern bank of the Nile, and near the middle of the temple range, lat. 26° N., the site of ancient Thebes. It comprises two distinct enclosures; the south-east enclosure was a product of the twelfth

dynasty under Uertsen I, about 1900 B. C.; the north-west enclosure was erected in the nineteenth dynasty, under Seti I, about 1300 B. C. There was an alley between them, about sixty feet wide, in which two stately obelisks were set as sentinels to guard the entrance. The outside breadth of the south-east enclosure is about 3652 inches, a ten-year symbol; the inside breadth is about 3360 inches, which represents the diameter of a circle whose circumference in Egyptian cubits is 512, equal to 10560 inches. The inside breadth of the north-west enclosure is 329 feet, equivalent to one-tenth of 365.25 inches multiplied by 4 times the cube of 3, that is, a Sun temple, perfect. The hypostyle, hall of columns, is 329 by 170 feet, equal to 2040 inches, which is the diameter of a circle whose circumference is 366 short cubits of 17.51 inches. The remaining area of the north-west enclosure is 329 by 275 feet. The number of sidereal days in 3 times 3 years is 3296.3; allowing one inch to a day, this number gives 274.7 feet, or in round numbers 275 feet. The company of the Egyptians' gods was always reckoned 9. Thus the various dimensions of the courts and halls of Karnak appear to represent in numeric symbolism the fundamental ideal of a temple dedicated to the Sun-god. The axial orientation of the great temple at Karnak is 26° 23′ 40″ S. of E., and the latitude is about 26° N. The sun's declination, 1900 B. C., at the solstices, was 23° 56′ 24″. From these elements it is found that at the winter solstice the sun's rising was 26° 22′ S. of E. as seen from Karnak, while its setting at the summer solstice was 26° 22′ N. of W. It thus appears that the axis of Kar-

nak was designed to welcome the solstitial sunrise at midwinter.

Ramesseum is on the west bank of the Nile, opposite Karnak. It comprises three sections on an axis that is 42 27′ S. of E. The entrance is at the south-east end into the largest section, whose outside breadth, 114.6 cubits, equals the circumference of a circle that has a diameter 36.5 cubits, and whose depth, including the pylon, is 108 cubits or one-twelfth of 1296. The inside breadth of this section is 180 feet, equal to 2160 inches, that is, one-tenth of the number of minutes in a circle. The breadth of the middle section outside measure is 101.52 cubits, that is $114.6 \times .8862$, the side of a square whose area equals that of the circle that has the diameter 114.6 cubits. The third section is 116.26 cubits deep, which is the diameter of the circle whose circumference is 365 cubits.

The porch of Denderah is 1620 inches broad, and comprises two squares of 810, that is one-sixteenth of 12960. The columns being three rows, three columns deep, the square thus allotted to each column is 270 by 270 inches, the famous number used by Plato in his square of 100 cubes of 3 to represent the Divine cycle of generation. The hall of six columns next beyond the porch is about 608 inches square, that is, the square inscribed in a circle whose circumference is 2700 inches. The pronaos is about 608 by 240 inches, and 240 is 129600 divided by twice 270. The court in which the sanctuary was set is about 608 by 986 inches, and 986 is 27 times 36.5. The sanctuary is about 260 by 490 inside, that is, one-fifth of 1296 or 27 times 18. All

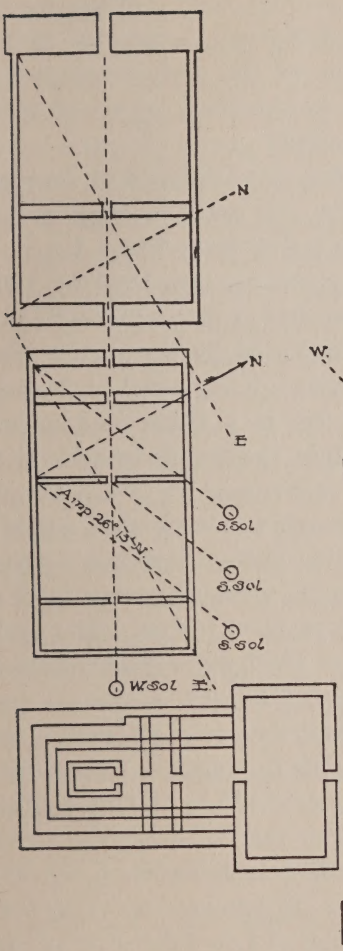


FIG. 53. KARNAK.
FIG. 55. DENDERAH.

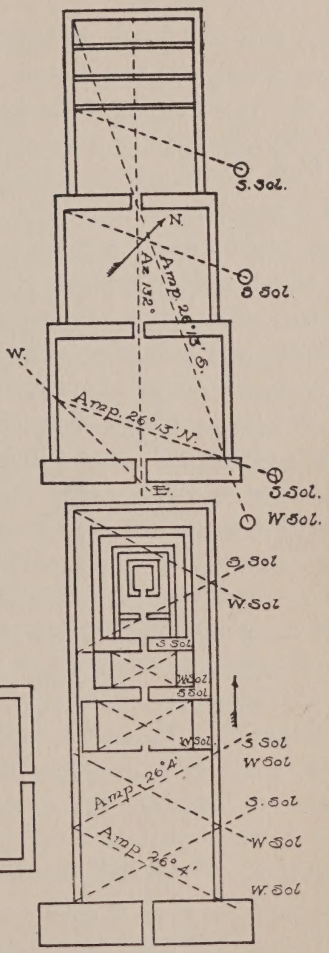


FIG. 54. RAMESSEUM.
FIG. 56. EDFU.

these floor measures are multiples of 3 or time symbols in combination with the revered 1296. When we reflect that Denderah was dedicated to the sun, as the most glorious manifestation of the perfect beneficence of the Merciful Supreme, the symbolic import of these numberings may be recognized.

Edfu, the temple of Horus, was dedicated to the sun; its entrance faces the south. Its extreme length is 450 feet, and its width outside is 150 feet; hence the plan of the temple comprises three squares, 1800 by 1800 inches, and each square consists of nine squares 600 by 600 inches; a further subdivision by three gives nine squares 200 by 200 inches, each being equal to the area of the circle whose diameter is 4 times 56.5 inches. Many of the wall lines within the temple coincide with the lines of the squares. Obviously Edfu is a temple of squares, wherein its likeness to Denderah is notable. The largest of Edfu's squares is 1800 inches or 5 times 360, a time symbol. A circle whose diameter is 1800 inches has a circumference of 5650 inches. The cycle of 600 years, or one-third of 1800, was anciently held in great reverence. The hypostyle wall comprises two squares 36 by 36 cubits, and the rectangle within the great court is twice 36 cubits in length. The pronaos enclosure comprises two squares 500 by 500 inches, that is a square equal in area to the circle of 565 inches diameter. Thus 565 and the time symbols 6, 60, 600 dominate the plan of Edfu. In harmony with this ideal is the numbering of columns,—12 on either side of the great court, 12 in the hypostyle, and 12 in the pronaos. The area of the largest square, 1800 by 1800, is one-

fourth of 12960000 inches. The temple was 180 years, 3 months and 14 days in building, being finished 57 B. C. It is almost as perfect as when it left the builders' hands. It was erected in the time of the Ptolemies, when great attention was given to astronomy. In the time of the Ptolemies, Denderah was rebuilt from foundations laid in the reign of King Khufu. On the ceiling of its portico is a representation of the zodiac.

As we look through the long avenue of astronomical associations connected with Egypt's temple architecture, and lift the veil that enshrines her reverent ideals of Divine activity in nature and in human affairs, it would be sad to part with our belief that the old inspiration begotten of a living faith in Divine beneficence never dies. Great masters and even races of greatness may perish, but their works after a long slumber, being unveiled, may stir new generations to possess the old ideals and see the Great Teacher of humanity still doing His work — His mighty work. Creation is one grand sacrament of the Divine presence; and while human activity in historic development is but the working out of the Divine ideal of loving companionship, the metrology of things above and things on earth is the record of what has been done and the promise of what shall be.

TEMPLE IDEALS IN THE EAST.

Long ago in the Orient, temples were built in seven stages, upon a square base, each stage being smaller in the ascent. The pagodas of China are of this class, but the number of stages is much more than seven. The

ziggurats of the East are good specimens; the name signifies mountain peaks, or peaks of the gods. We give here in detail a notable one at Babylon; the measurement of its seven stages, inscribed on a palette, was found by George Smith, Fellow of the Royal Geographical Society, London.

The lowest stage is 3600 inches square.
The second " " 3120 " "
The third " " 2400 " "
The fourth " " 2040 " "
The fifth " " 1680 " "
The sixth " " 1320 " "
The seventh " " 840 by 960 inches.
The height of the edifice is 3600 inches.
The area of the lowest section is 12960000 inches.

The length of consecutive stages from the third to the seventh diminishes by 360 inches. The differences between the first and second, and second and third, are 480 and 720; all these differences are factors of 129600. From this it appears that, by inch units, 360 is a dominant measure; in other words, it is one-third of 100 Gudea rods of 10.8 inches. Now the Gudea rule has sixteen divisions, but the subdivisions are such as to give exactly the measure of one-third of 10.8 inches. But again taking the Egyptian cubit 20.625 as the unit of measure, the second stage is 7 times 21.6 cubits = 3118.5 inches; Mr. Smith's measure is 3120 inches; the third stage is $365.25 \div 3.1416$ cubits equal to 2398 inches; Mr. Smith's measure is 2400 inches; the fourth stage is 2040 inches equal to 70 cubits $\div$ .7071. The fifth stage is the diameter of a circle whose circum-

ference is 7 times 36.525 cubits, equal to 139.87 feet; Mr. Smith's measure is 140 feet. The perimeter of the sixth is 7 times 36.625 cubits, or 110.1 feet square; Mr. Smith's measure is 110 feet. The long side of

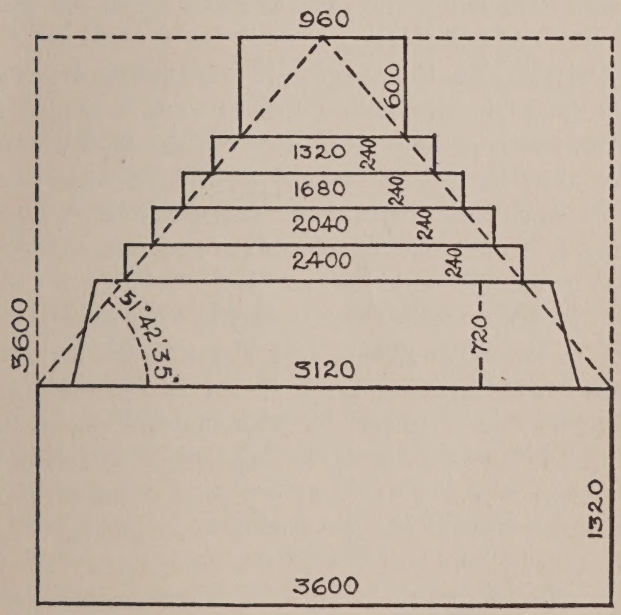


FIG. 57. TEMPLE OF JUPITER BELUS.

the seventh stage is 80 feet, which is 4 times the diameter of the circle whose circumference is 36.525 cubits. The short side, 70 feet, is the circumference of the circle whose diameter is 12.96 cubits. The height of the seventh stage is 50 feet, equal to one-third of the diameter of the circle whose circumference is 365.25

cubits; and the height of each of the next lower stages is 20 feet, that is the diameter of the circle whose circumference is 36.525 cubits. The second stage is 60 feet high, equal to the diameter of the circle whose circumference is 3 times 36.525 cubits. The combined height of the four corners of the first stage is 440 feet, or 7 times 36.625 cubits.

From these coincidences it appears that the architectural design of this edifice was to erect a temple of sevens, which in its several stages would represent by cubit units the sidereal year cycle, 366.256; the equinoctial year cycle, 365.25, and the number 1296, which by inches is the circumference of the circle whose radius is ten cubits, 206.25 inches.

Herodotus describes this temple as "the sacred precinct of Jupiter Belus." The ziggurats are terraced altars, in solid masonry, called Mounts of Paradise, God Thrones, Peaks of Meru. Nebuchadnezzar restored and beautified one of these at Borsippa, close to Babylon. Rawlinson says the seven stages were ornamented in colors, to represent the seven planets or great orbs of heaven; the Sun was golden, the Moon silver-white, Saturn the far distant black, Jupiter orange, Mars red, Venus pale yellow, Mercury deep blue. By this arrangement the first stage of the ziggurat was black; the second, orange; the third, red; the fourth, golden; the fifth, pale yellow; the sixth, deep blue; the seventh, silver-white. A subtle appreciation of Nature's order and beauty was thus set up in the midst of ancient civilizations. Through the ages of strife the god-thrones stood in the sublimity of eternal repose. As

the Christian cross is the symbol of Christian faith, so the terraced altar of India was her symbol of belief in Divine sovereignty. The native millions understood its purport. Its sevenness was the embodiment of an ideal rest that dominated the ancient life of India. Even in times of greatest activity the consciousness of repose was not lost. Her intellectual atmosphere was like the dawn or twilight of a summer day. It touched all forms of her philosophy of life, and all her philosophy was religious, and religion was ideal *rest* in the bosom of the Infinite. The philosophies were numerous, but only variations of the sublime Yoga, whose seven stages of ascent were the necessary preparation for entrance into the eighth and highest stage, the splendor of celestial life, which could not be presented in finite form, in which, however, human personality was not destroyed, but so lost to itself that only God and the activities of God came within its consciousness. As an outline of this philosophy, the religion of Buddhism, we give the following:

First stage, Observation. By this a man comes to know himself, his own existence. Without it the stars tell him nothing, Nature is silent. It is the beginning of knowledge and wisdom; without it truth hides herself and may neither be touched nor kissed.

Second stage, Endeavoring, Action. By this a man reproduces in ideal form what he has observed in nature. Observation bears no fruit without Endeavoring.

Third stage, Position. This means right relation to Nature's order. The Yoga says, Observe her ways and thereto adjust your life. This is Position: it in-

volves sacrifice and self-restraint, but without it the next stage cannot be reached.

Fourth stage, Detention. This is to hold fast what has been found by Observation, to make firm the results of Endeavoring, and religiously to preserve Position; to let nothing escape that is beautiful and good and true, to give it a perpetual embodiment in life. The stars, the mountain peaks, the eternal whiteness of the most lofty are lessons in Detention. To hold friendships and not part with them, this is Detention.

Fifth stage, Results of Detention. Good order in life, unbroken relations, stability of faith, fixedness of laws.

Sixth stage, Retention. In this stage truth is no longer outside of a man, but within; his soul becomes her home, he feels her inspiration, in him she breathes and speaks, he serves without fear, Nature lifts her veil and he sees the Divine ideal; illimitable perfection possesses his vision, and as it is transfigured into experience all things stand in the garment of light. Retention gives sight, splendor, brightness to the soul's life. Nature's door is wide open to him who has entered the sixth stage, and he is welcomed to drink her high ideals of truth without restraint. If much is given, much is required.

Seventh stage, Meditation. This is spiritual repose. The priest of Buddha retires to the shade of his tree for rest and communion with the Great Ideal of nature. The world's strife does not reach him; he is alone, and not alone. Treasures come at his call, the choicest come of their own will and in their own time; he welcomes them; they are his own to know, to feel, to

enjoy. All is so restful, and he looks into the bosom of deep waters to find satisfaction in the celestial beauty that looks up into his face. Without Meditation not half the truth is seen; in the whirl of ambition Truth is timid and easily hurt by quick words and sharp deeds. To the old priest who is ready to enter the eighth stage, the indefinable, she is radiant with hope; it is a vision of what is above and below and beyond.

Eighth stage, Absorption. This is not personal extinction, but entrance into the fullness of perfect life; there is no higher stage, it is the last that is possible. The law of the Yoga is that all periodic actions developed under the inspiration of the Invisible are measured by ideal cycles, which are expressed in geometric form by the number 1296, thousand or thousands of thousands. Position, the third stage of the Yoga, is represented by the third part of 1296, that is, 432, which is the symbol of consecration, of standing in harmony with Nature's beauty and order. The geometric circle comprises 21600 minutes; one-fifth of this is 4320, which is full consecration. The cycles of the Yoga are three, each in numeric symbolism being 4320 million years, or 4320 times the cube of 100, which signifies the complete containment of full consecration. This is Absorption, entering into the splendor of Divine perfection and righteousness. To know this, to feel it, to be lost in the reverent contemplation and experience of it, this is Absorption. To-day the terraced altars in Persia and India are but mutilated symbols of a faith that had immense influence, and gave peace and comfort to many millions through long ages of human conflict.

For the eighth stage, that is beyond things visible, there was no finite similitude. The immeasurable cycles of full and complete consecration could only be expressed by the numeric symbol of 4320 million years taken threefold to make the cycle of perfection, 1000 times 12960000.

The practice of deep breathing was religiously observed by Yogins under the following instructions, obviously to promote health and secure a habit of mental concentration and control; they are prescribed for the fourth stage preparatory to the higher stages:

1. Inhale 7.6788 seconds, suspend 30.7152 seconds.
   Exhale 15.3576 seconds.
2. Inhale 30.7152 seconds.
   Exhale 7.6788 seconds, suspend 30.7152 seconds.
   Exhale 15.3576 seconds.
3. Inhale 7.6788 seconds, suspend 30.7152 seconds.
   Exhale 15.3576 seconds.

This ideal breathing is satisfied when suspension reaches in the

5th stage 10 m. 48 sec., equal to $\frac{1}{2}$ of 1296 sec.
6th " 21 m. 36 sec., equal to .... 1296 sec.
7th " 43 m. 12 sec., equal to 2×1296 sec.
8th " 86 m. 24 sec., equal to 4×1296 sec.

Om, "glory," is said in the 6th stage 144000 or $\frac{1}{9}$ of 1296000 times.

The largest breathing number is 30.7152 seconds. Now the length of the solar day increases about 18 seconds daily on its approach to the vernal equinox, when the increase amounts to 7 minutes 25 seconds;

this being added to the mean day of 24 hours gives 24.12378 hours, equal to 86845.6 seconds, and one-ninth of the diameter of a circle having this circumference is 3071.52 seconds, that is, one hundred times the largest breathing number.

The measurement of a breathing to the ten thousandth part of a second is inconceivable; it appears, therefore, that the number 30.7152 seconds is associated with the life-growing activity of the sun announced at the vernal equinox — the other breathing numbers are one-half and one-fourth of this — and the suspension numbers must be regarded as symbols of religious states of the soul, 1296 representing a cycle of religious experience, and the Yogin's recognition of inspired life.

The most eastern of Oriental nations, Japan, has preserved from an unknown origin a remarkable use of symbolic numbers in her five great festivals, as follows:

1st,	on the	7th	day of the	1st	month.		
2d,	"	3d	"	"	3d	"	for girls.
3d,	"	5th	"	"	5th	"	for boys.
4th,	"	7th	"	"	7th	"	for lovers.
5th,	"	9th	"	"	9th	"	for all people.

The festival of the ninth month is a harvest gathering of all the people as a national brotherhood, and exhibits the great ideal of companionship expressed by the Egyptians in their nine gods. It represents the organic fullness of the forces of nature. The feast of the seventh month is associated with the Japanese legend of the sun-father who after seven years forgave his beautiful daughter for chosing a herdsman instead

of a warrior for a husband, and allowed her to visit her lover on the seventh day of the seventh month of every seventh year. The legend evidently signifies that the splendor of a nation is better served by agricultural industries than by war. It is a legend of peace, forgiveness and reconciliation. The festival of the fifth month, for boys, is a fine recognition of the possibilities of righteous government and authority to be exercised by the boys in their manhood, five being the numeric symbol of law, order, sovereignty. The festival of the third month, for girls, may well represent the Japanese ideal of beauty, perfection and harmony, which is comprised in three, the perfect number. The festival of the first month, being on the seventh day, may represent a notable feature in Japanese life — the ideal of satisfaction and peace in national unity, the symbolisms of one and seven combined.

Chinese literature is fruitful in the use of numeric symbols, but we can only refer to the Chinese classic *I King*, commonly called the Book of Changes, in which an elaborate code of ethics is developed in numerical terms from the ideals of unity, reproduction, harmony and construction, which are comprised in the numeric symbols one, two, three and four.

The traces of symbolic art we have followed in this study are but fragments of the idealism that dominated the ancient energies of civilization. From the very beginning of human consciousness and through all ages of the past, the Infinite has been in living touch with the finite, giving men fresh inspirations of light as they were able to bear it, and leading them to higher levels

of companionship in search of truth. A mound of earth or a heap of stones, no less than the great cathedral dome, bears the impress of belief in the Brooding Spirit. Differ as beliefs do, the golden vein of truth runs through the monumental work of ancient peoples, very light in some, very heavy in others, but the same thread in all. So numeric symbolisms in the old temples whose ruins we venerate are the tracings of faith, drawn by men inspired to behold some fragment of truth and to create for it a finite likeness. It is the work of Divine art which forever and ever in finite form reproduces ideals of the Infinite.

CHAPTER IX.

THE GREAT PYRAMID.

THIS famous monument was erected not less than one hundred and fifty years before the death of Noah. Though stripped of its polished casing, the venerable structure holds the wondering eye of many pilgrims. It is eight miles north of Memphis, the ancient metropolis of Egyptian wisdom. Overlooking the Lybian desert, it stands upon the edge of a bluff where the vast amount of chips made in stone-dressing could be easily put away. It was built of huge blocks laid in receding courses, which gave the sides a step-like appearance; then a finishing course was placed on each step, with its outer face cut to give the edifice a continuous ascent of about 52°. Its fine workmanship is unequaled in the best masonry of modern times. What was its ideal design? Perhaps the question will never be fully answered. To the eye of many observers it is a royal tomb, in the company of tombs. Two similar monuments, smaller and less perfect in workmanship, are near by, and many others more or less remote indicate a period of pyramid building. In some of these a human body or skeleton has been found, but there is no evidence that a body was ever entombed in the Great Pyramid.

For many centuries the entrance was unknown even to the people who lived in its vicinity; but, when discovered, a passage barely large enough for a man to

crawl through was found, which led to curiously constructed chambers, the largest being a sloping gallery one hundred and fifty feet long, nearly thirty feet high, and about seven feet wide. Since that discovery the French, under Napoleon, made a survey to ascertain the dimensions of the edifice. English explorers attacked the problem, and in 1864–5 the late Astronomer Royal

FIG. 58. THE GREAT PYRAMID.
From "Ancient Egypt," by Chas. H. S. Davis, Ph. D.

of Scotland, C. Piazzi Smyth, made extensive measurements which were taken to support a metrological theory of its design; but the subsequent survey by Wm. M. F. Petrie in 1880 and 1882 surpasses all others in extent, accuracy, and minuteness of detail. His investigations were published in 1884, in a quarto volume entitled *The Pyramids of Gizeh.* While this survey may dispel some of the illusions that had grown out of Pyramid observations, it confirms beyond reasonable doubt the theory that the structure bears a strong geometrical and metrological character.

Being the largest of its kind, it is called the Great Pyramid; but if the name Pyramid be derived from *pyr*, something beautiful, white, bright or glorious, and *meddah*, that which is measured, it should signify The Beautiful Measure. If this unique piece of architecture be a product of metrological wisdom, we might examine it in the belief that its author knew what to say and how to say it in language accurate and intelligible. Fortunately its value as a metrological prodigy can be severely tested by comparing its lines with the accepted facts of nature. Mr. Petrie has given us the limit of possible error in the details of his survey.

BASE LINES.

The geographical location of this edifice is 29° 58′ 51″ N. lat., and about 31° 10′ E. long. The bluff on which it stands is two hundred feet above the Nile. A great part of its material was taken from the sandstone quarries of the upper Nile; but limestone was used for the pavement, which was about fifty feet wide, around about the base. The outside casing was like white marble; the passages and chambers within are of granite. In appearance it is a right pyramid, square at the base. In the bed rock at every corner there is a socket or excavation, about six inches deep, with floor well leveled, as follows:

S. E. socket	about	51 by 86	inches,	level		0 inches.
N. E.	"	" 138 by 152	"		"	+11.4 "
N. W.	"	" 90 by 120	"	±	"	+ 7.1 "
S. W.	"	" 70 by 138	"		"	+16.9 "

Each of the last three, according to its level above the south-east socket, is located nearer the centre of the edifice, while the outer corners of sockets diagonally opposite are on lines that cross at a right angle in the centre,— facts which show that the outer corners of the sockets were originally determined with extreme ac-

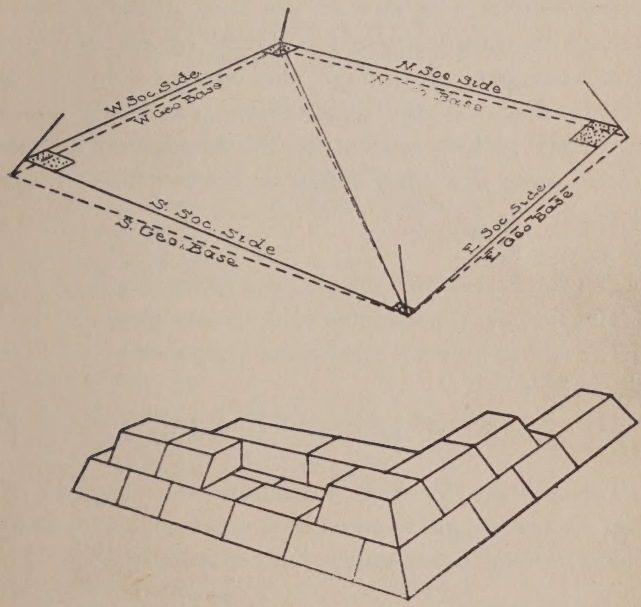


FIG. 59. FOUNDATION, CORNER OF CASING RESTORED.

curacy. Mr. Petrie could not determine by his instruments an error in this quadrantal feature of the foundation plan. He gives, in inches, the distance between the outer corners of the sockets on every side, which he calls socket sides or edges. His measures and azimuth of the socket edges are as follows:

E. side	9130.8 ± .6	inches; azimuth	— 5′ 21″
N. "	9129.8 ± .6	" "	— 3′ 20″
W. "	9119.2 ± .6	" "	— 7′ 33″
S. "	9123.9 ± .6	" "	+ 1′ 15″

These are the measures of the socket base; the geometric base is a square on the level of the south-east socket; its four corners are found by extending the arris lines passing through the outer corners of the sockets down to the level of the south-east socket. Obviously in this concept of the foundation six lines radiate from the outer corner of the south-east socket, to wit:

The south and east sides of the geometric base.

The south and east sides of the socket base.

The south-east to north-west diagonal of the geometric base.

The south-east to north-west diagonal of the socket base.

These lines, by inch measures, according to Mr. Petrie's survey, are in numerical agreement with astronomical periods and distances, as follows:

(a)	25 equinoctial years	9131.056 days
	The E. socket side is	9130.8 ± .6 inches
(b)	Full lunations in 25 years . . .	9124.9 days
	The S. socket side	9123.9 ± .6 inches
(c)	Precession of the equinoxes 5000 B. C., annual	50.16″
	One-half of the great solar cycle at 50.16″, annual	12916.5 years
	S. E. to N.W. diagonal of socket base	12916.2 inches

	First Dynasty, Egypt, 5004 B. C. (Mariette).	
	First Dynasty, Egypt, 5650 B. C. (Wiederman).	
(d)	Earth's equinoctial distance from sun	91400000 miles
	E. geometric base	9139.7 ± .6 inches
(e)	Earth's mean solar distance (Lockyer)	91430000 miles
	N. geometric base	9144.3 ± .6 inches
(f)	Azimuth of sun's apparent motion towards the equator at the autumnal equinox, 2000 B. C. . . .	3′ 50″ S. of W.
	Azimuth of S. geometric base, ± 12″	3′ 50″ S. of W.
(g)	Distance between mid-slope lines of N. and S. faces, extended to and measured on the geometric base, 9068.15 + 62.67	9130.8 ± .6 inches
	25 equinoctial years	9131.056 days
(h)	Distance between mid-slope lines of E. and W. faces on the geometric base, 9069.5 + 62.67 . . .	9132.17 ± .6 inches
	25 sidereal years	9131.4 days
(i)	S. socket edge 9124.5 + .7854 × 18, original level of the S. W. socket .	9138.63 ± .6 ins.
	Ideal geometric base, 500 cubits × .8862	9139.14 inches
	French measure to scored line in rock, S. W. corner from S. E. corner .	9140. inches
(j)	Geometric height at Pi pitch, 9139.14 ÷ 2 × .7854	5818.1 inches
	Petrie's estimate, 5776 + 39.9 for pavement	5815.9 ± 7. inches

Mr. Petrie shows that the faces of the Pyramid are curved inwardly, so that the casing stones *in situ* about midway of the faces are inside of the arris lines at pavement level. No reason for this curvature appears

in the records of the survey, but the foregoing coincidences, (g) and (h), may afford a satisfactory explanation. It is difficult to accept this long list of numerical agreements between important astronomical data and Mr. Petrie's survey as accidental coincidences, without seriously impairing our confidence in the legitimacy of any conclusions that may be drawn from a numerical analysis of physical facts.

The area of the ideal geometric base is equal to that of the circle whose diameter is 500 cubits; and the square of 500 cubits is integrally equal to the area of the circle whose diameter is 565 cubits. This establishes a numerical and geometric connection between the Great Pyramid and the fundamental base of all the ancient metrologies, that is, the circle of 1296000″ whose radius on the scale of one inch to 1″ is 10000 cubits, or 206250 inches. The pavement about the Pyramid was 500 cubits square, the measure of Ezekiel's prophetic city. Mr. Petrie found rock dressings for the pavement on the north-west side, 618.9 inches beyond the face of the Pyramid, and on the south-west side 627 inches beyond the face; the mean of these measures is 622.8 inches. If the original pavement had a like extension on the other sides, the whole breadth would have been $2 \times 622.8 + 9068$, equal to 10313, or integrally, 500 cubits, equal to 10312.5 inches.

TRENCHES AND BASALT SQUARE.

Adjoining the Pyramid midway on the east side, there was a beautiful basalt square, two inches above the level of the limestone pavement, and covering about

one-third of an acre; it is much broken up, and only one-fourth of it remains *in situ*. Nothing of it is left around the edges, but the dressed rock on which it was laid shows that its centre was 1056 inches east of the geometric base of the Pyramid. On the north side of this square is a meridional trench 20 feet deep and 100 cubits long; a similar trench is on the south side.

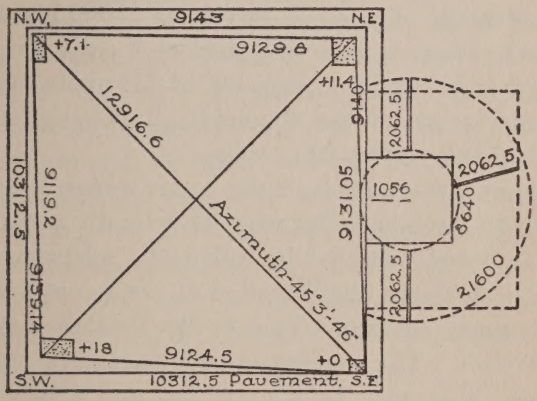


FIG. 60. TRENCHES.

They are so placed that the east side of the north trench extended southward, would overlap the west side of the south trench by four or five inches. With this arrangement, the reflection of a star from water in the trenches, at the moment it crossed the meridian of the basalt centre, could be seen in both trenches at once. The breadth of the present excavations ranges from eleven to seventeen feet; but making due allowance for the thickness of the lining, twenty feet high, which has been removed, the probable breadth of the finished

trenches was two to four cubits, the greater breadth being at the southern end of both trenches. From Mr. Petrie's survey, it appears that the inner ends of the finished trenches were in the circumference of a circle whose centre is the centre of the basalt square, and whose circumference is 8640 inches, that is, two-thirds of 12960, or one-tenth of the number of seconds in one day. It also appears that the outer ends were in the circumference of a circle measuring 21600 inches, that is, the number of miles in a parallel of latitude passing through the northern precincts of Memphis, or about 3.5 miles south of the Pyramid. The length of each trench therefore was 100 cubits.

Running eastward from the basalt square is a similar trench 100 cubits in length; its azimuth is 14° 1′ 37″ north of east. It may be called the solstitial trench, because it marks the direction of the sun at 6 A. M. at the summer solstice. This is Mr. Petrie's east-north-east trench. The moment or hour of sunrise was held in great reverence by ancient nations; hence temple gates or doors opened to the east to welcome the Divine beneficence. On the pavement of the temple of Helios, Athens, there is a carefully engraved line whose azimuth is 14° 11′ north of east. (*Legende Athenienne, Bournouf.*) The latitude of Athens is 37° 58′ north, that is 8° north of the Pyramid, and the azimuth of the sun at 6 A. M., at Athens, at the summer solstice, is somewhat more to the north of east than at the Pyramid.

It appears in the survey that the azimuth of the north side of the basalt square was 21′ 28″ ± 12″ south

of east; a change of one-tenth of an inch in locating the corners of the square would make the azimuth 21′ 12″, which was the equinoctial precession for twenty-five years in the twenty-second century B. C. (*Stockwell*). If, therefore, in laying out the basalt square, the intention was to make its sides tangent to a circle whose radius is equal to 1″ of longitude at the latitude of 29° 56′, and its azimuth represent twenty-five years of precession, the work was admirably done, for the agreements with Mr. Petrie's survey are within the fraction of an inch. In view of these coincidences there seems to be reasonable ground for belief that the basalt square and the great trenches connected with it were designed to represent important geodetic and astronomical facts. Natural measures of this kind belonged to Indian, Assyrian, Egyptian, classic and mediaeval architecture, often in combination with the numbers 565, 1056, 5156, 1296 and 432, which are comprised in the cubit rod of 20.625 inches.

PASSAGES AND FLOOR LINES.

Now if the foundation lines of the Pyramid have a symbolic character, geodetic and astronomic, we may reasonably anticipate numeric symbolism in the metrology of its passages and chambers. The double cubit is the breadth of the passages, 56.5 digits; that is, 41.25 inches (equal to 56.5 digits, or 8 times 5.156 inches), which is the diameter of the circle whose circumference is 129.6 inches. The perpendicular depth of passages is 47 inches, equal to one-twelfth of 565 inches. By Mr.

Petrie's survey we find that the floor line from the pavement up to the entrance and thence to the king's chamber is 5650 inches, as follows:

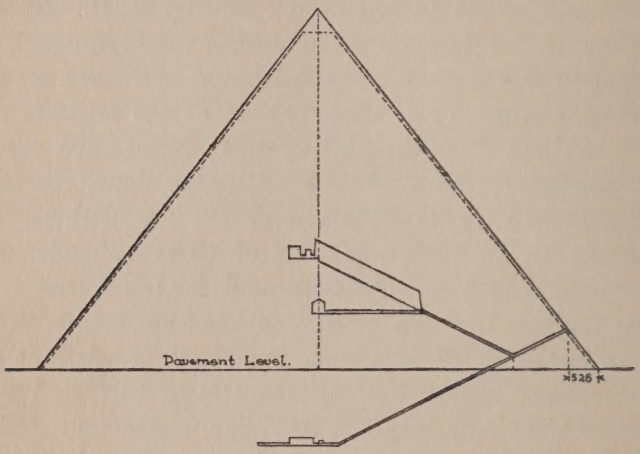


FIG. 61. PASSAGES AND CHAMBERS.

Outside slope up to the entrance . .	848.20 inches
Thence to the junction of floor lines .	1110.64 "
Thence to the gallery	1546.80 "
Thence to the great step	1815.50 "
Thence to the king's chamber . . .	330.20 "
Total distance, 10 times 565 . . .	5651.34 ± .9

The floor line from the pavement to the middle of the niche in the queen's chamber is 5156 inches, as follows:

Outside slope up to entrance . . .	848.20 inches
Thence to junction of floor lines . .	1110.64 "
Thence to the gallery	1546.80 "
Thence to the north side of niche . .	1620.70 "
Thence to middle of niche . . .	30.72 "
Total distance, 5156	5157.06 ± .9

The alphabetic form of these measurements is 10 times H V H for 5650, and H J H V, The J H V, for 5156.

The J H V number, 1056, by inches, is a notable feature in the Pyramid design. The sloping distance from the vertex to the geometric base on the north side is 7 times 1056 inches. The floor entrance is horizontally inside this slope at pavement level, 528 inches, one-half of 1056. Mr. Petrie's measure is $524.1 \pm .3$ inside of the casing, to which must be added 4 inches on account of the curvature of the casing already noted. The west side of the entrance passage is 264 inches, or one-fourth of 1056, eastward of the mid-line slope. The junction of the floor lines of the entrance and ascending passages is 1520.64, or 10.56 times 144 inches, horizontally southward of the mid-line slope at pavement level. The floor line from the junction up through the ascending passage to the foot of the great step in the south end of the gallery is 3362 inches, equal to $10560 \div$ Pi; Mr. Petrie's measure is $1546.5 + 1815.5$. The horizontal distance from the step to the north end of the gallery is 2 times 77×10.56, equal to 1626.24 inches. Mr. Petrie's measure is 1626.8 ± 8. From the step to the north side of the king's chamber the distance is 330 inches, equal to $\frac{1}{4}$ of $\frac{1}{8}$ of 10560. Mr. Petrie's measure is $330 \pm .9$. The west side of the passage to the king's chamber is eastward of the centre of the Pyramid, 264 inches, or one-fourth of 1056. The roof of the subterranean chamber is 1056 inches below the pavement. The south socket side, 9123.8 inches, is integrally 2 times 43.2×105.6. Integrally, the number of days in

the 309 lunations of 25 years is 9124, equal to 2 × 43.2 × 105.6. The year number, 365 ÷ 8, equals 45.62, or 43.2 times 1.056. The circle inscribed in the basalt square has the radius 1056 inches. The mean level of the four sockets in the foundation of the Pyramid before the settlement of the south-west corner (one inch) was 9.125 inches, or one-fourth of 36.5, and the radius of the circle inscribed in the casing slope at this level is 4562 inches, or 43.2 times 105.6; so that all the socket sides are tangent to a cone inscribed within the Pyramid's casing when it is extended downward to the level of the geometric base.

The number of courses from the pavement to the entrance is 18, which coincides with the number of generations from Adam to Abraham. At 432 inches horizontally from the entrance a line is scored on the west wall of the passage; it is 1950 inches horizontally from the gallery, and may coincide with the marriage of Abraham and Sarah, or the birth of Bethuel, the father of Rebekah, 1950 B. B. C. The wall joints of the entrance passage are perpendicular to the floor slope, except two vertical joints on either side, one being 1958 and the other 2012 inches horizontally north of the gallery. Abraham was born 1992 B. B. C., which coincides with the midway position of these exceptional joints. At the level of 1137.4 inches above the pavement a remarkably thick course—50 inches—was laid; its upper surface coincides with the north end of the roof of the gallery, and the middle line of its face outside was 1992 inches from the north door of the gallery, thus numerically coinciding with the date of Abraham's

birth, 1992 B. B. C.; but its mid-line is above the pavement 1162.5 inches, equal to 3652.4 divided by 3.1416. The original entrance, 4010 inches from the centre, lay in a square whose perimeter is equal to that of a circle having the diameter 2 times 5105.6 inches, the numeric symbol of the likeness of The J H V. The floor line from the floor junction to the gallery is 1546.8 inches, that is, 3 times 515.6; the numeric symbol of perfection is 3, and 515.6 is The J H V. The floor line or sloping length of the gallery is 1883.6, equal to 365.25 times 5.156, that is, the day or splendor of The J H V.

The placement of the entrance is about 24 feet eastward of the middle of the north face of the Pyramid; as seen from the centre or vertex of the edifice it is 4° 3′ E. of N., which coincides with the longitude of Jerusalem and Bethlehem, east of the Pyramid, that is, 35° 13′ — 31° 10′. The north geometric base of the Pyramid is 2943.18 ± .8 inches horizontally from the entrance of the gallery, which coincides with the date of Noah's birth, 2944 B. B. C.

Time units have a conspicuous place in these measures; they belong to history, and history is the record of human affairs. Hebrew chronology comprises such a record, covering 4000 years; it is very minute in many details, and notably a record of generations. Whether its earliest generation numbers are severely historical or somewhat symbolic in form and purpose may be an open question. It is written that from Abraham to David were fourteen generations, but the details of that interval make a period of 980 years, which would give seventy years for a generation, a term far beyond the

average of human life. Many births in the line of descent must have been omitted, yet the line is preserved. In Hebrew song the days of man are reckoned seventy years; that is, in the language of numeric symbolism, a full measure of satisfaction. This suggests the possibility of a technical or symbolic notation in the record of antediluvian generations. In this view of the subject the name of a patriarch may stand for the life of a family in its male line, and the genealogy of Hebrew parentage is correctly recorded in the Hebrew Scriptures.

FLOOR STONES.

If these numerical coincidences with historic dates touching Hebrew ancestry are not accidental, we may expect to find many more of the same character appertaining to that remarkable race.

Mr. Petrie's survey gives the thickness of every course of masonry from the pavement to the present mutilated top, which is about thirty feet square. The entrance is on the eighteenth course and 667 ± 1. inches above the pavement. The Deluge occurred in the 600th year of Noachian life, that is, 2344 B. B. C. The floor of the entrance was 2383 ± .8 inches north of the gallery, and the roof was 2353 inches north of the gallery. Thus the date of the Deluge B. B. C. coincides with a point nine inches inside of the roof of the entrance, which was closed with a stone door.

The survey gives the position of every floor joint from the present beginning of the entrance passage to the north end of the gallery; there is no difficulty in

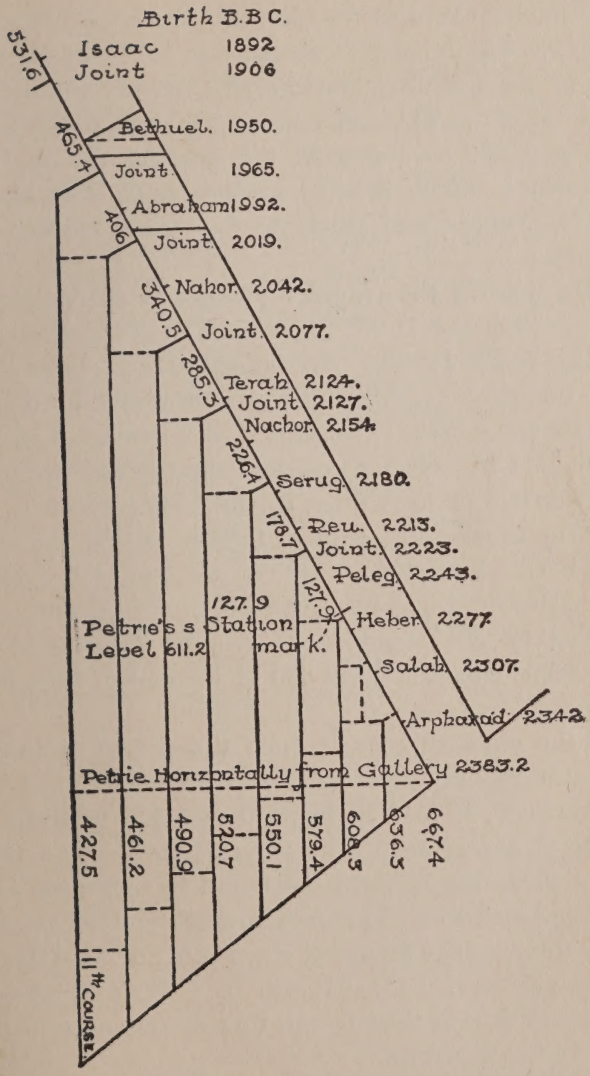


FIG. 62. MASONRY COURSES.

determining the horizontal distance of any joint from the gallery. The dip of the entrance floor is 26° 26′ 42″; the rise of the ascending passage that reaches the gallery is 26° 12′ 30″. This difference in the slope of the floors is due partly to a general tilt towards the south or south-west, which appears in the south wall of the king's chamber, and partly to depression beneath the gallery.

The slope of the entrance passage in the vicinity of the floor junction is 26° 21′, while that of the ascending passage is 26° 12′ 30″. If originally the angle of slope was the same for both passages, it would have been 26° 16′ 45″ ± 20″. The slope of the floor of the gallery is 26° 16′ 45″. Owing to changes that have taken place in the levels of the edifice, it may be impossible to determine exactly the original incline of the passages. We have taken 26° 16′ 30″ as the probable average from the entrance to the north end of the gallery. According to this angle, the horizontal distance of the floor joints from the north end of the gallery have been computed.

If the eighteen courses from the pavement to the entrance represent eighteen generations from Adam to Abraham, it may be inferred that the positions of the floor stones have a symbolic import. The table below gives the horizontal distance in inches of each joint (marked by a —) from the north end of the gallery; the numbers following the names are the dates of Hebrew births B. B. C. It will be observed that generally one date in the Hebrew line corresponds to one stone in the floor line.

Births, Joints.	B. B. C.	Births, Joints.	B. B. C.	Births, Joints.	B. B. C.
Noah	2944	—	1642	—	942
Shem	2442	Aminadab	1607	Joram *x*	917
Entrance	2383	—	1595		
Deluge	2344	Moses	1567	Ahaziah *x*	
— ?		—	1562		
Arphaxad	2342	Naasson	1522	Joash	892
— ?	2330	—	1519	—	892
Salah	2307	Exodus	1487	Amaziah	855
— ?	2300	—	1483	—	845
Eber	2277	Salmon	1471	Uzziah	817
—	2272	—	1461	—	800
Peleg	2243	Jordan crossed	1447	Joatham	774
—	2223	—	1429		
Reu *x*	2213	Booz ?	1380	Achaz *x*	
—		—	1372	—	745
Serug	2181	Ruth ?	1335	Ezekias	743
—	2180	Plug	1324	—	715
Nachor	2154	Plug		Manasses	701
—	2127	Plug		—	671
Terah	2124	Obed ?	1290	Amon *x*	662
—	2077	Plug			
Nahor ?	2042	Jesse ?	1166	Josias	643
—	2019	Plug	1141	—	621
Abraham	1992	Samuel, prophet	1130	Jehoahaz *x*	
—	1965	—	1120		
Bethuel ?	1950	Saul ?	1115	Jechonias	607
—	1906	—	1088	—	595
Isaac	1892	David ?	1082	Salathiel	589
—	1860	—	1051	—	560
Jacob	1832	Solomon	1029	Zorobabel	543
—	1804	— ?	1028	—	531
Judah	1764	Rehoboam	1011	Rhesa.	
—	1755			—	483
Phares ?		Abia *x*		Abiud ?	
—	1723	—	985	—	453
Esrom ?		Asa	964	Eliakim ?	
—	1687	Josaphat *x*	945	—	419
Aram ?		—	942		

Births, Joints.	B. B. C.	Births, Joints.	B. B. C.	Births, Joints.	B. B. C.
Azor ?		Eliud ?		Heli ?	
—	374	—	261	—	160
Sadoc ?		Eleazar ?		Jacob ?	
—	346	—	232	—	108
Achim ?		Matthan ?		Joseph ?	60
—	310	—	188	—	53
				Mary ?	24
				Gallery	0

In this series two or more births sometimes, as in the day of the Kings of Judah, correspond to one stone, but of every name marked x it is said, "He did evil in the sight of the Lord." B. B. C. denotes Before Birth of Christ.

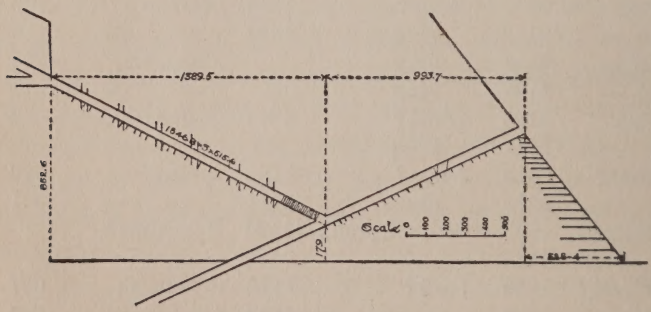


FIG. 63. ELEVATION FROM PAVEMENT TO GALLERY.

The full-writ chronology of regal times in Hebrew history is somewhat confused in itself and not in accord with contemporary events as recorded on the Assyria monuments; it may be that this is due to misreading the abbreviated numerical notation used in the earlier Hebrew manuscripts, and by all Oriental peoples, even before the exodus from Egypt.

GIRDLE BLOCKS.

The roof of the ascending passage has a peculiar construction (first discovered by Wayman Dixon, C. E.), consisting of five sets of girdle blocks placed at intervals of ten cubits along the slope, three blocks in a set. The joints of these blocks are horizontal, and the distance, vertically, between the upper and lower joints is three cubits. "The three roof blocks between the two horizontal joints are all girdle blocks, either wholly round the passage or partially so." (*Petrie*). If the positions of floor stones represent generations from Shem to Christ, we might infer that the positions of the girdle blocks have a symbolic relation to Hebrew history. The great feast of the Passover was instituted 1491 B. C. or 1487 B. B. C. It marked the beginning of the sacred year. The Mosaic reckoning of time by sevens comprised a cycle of seven days, one of seven months, one of seven years, and the great Jubilee cycle of seven times seven years together with the following year of Jubilee. The birth of Christ was in the thirtieth Jubilee cycle, which closed with the thirteenth year after the birth; that is, the year of His appearing before the doctors in the temple. The crucifixion therefore occurred near the midst of the thirty-first Jubilee cycle. The following table shows the positions of the girdle blocks in relation to the Jubilee cycles; the girdle numbers denote by inches the horizontal distance of joints from the gallery, and the other numbers denote dates B. B. C.:

The Passover instituted, B. B. C.	1487	
Junction of floors	1389	
Second Jubilee Passover	1387	
Girdles about the plug	1323	1141
The fourth to seventh Jubilee Passovers	1287	1137
Deborah and Gideon, Barak, Samson	1292	1141
Girdles, first set above the plug	1120	1080
Jubilee cycle	1137	1087
Samuel, the prophet and judge	1130	1090
Girdles, second set above the plug	940	890
Jubilee cycle	937	887
Elijah, Elisha	954	885
Girdles, third set above the plug	740	700
Jubilee cycle	737	687
Isaiah, Hosea, Nahum, Micah	756	694
Girdles, fourth set above the plug	560	520
Jubilee cycle	587	537
Jeremiah, Daniel, Ezekiel, Haggai, Zechariah	590	530
Girdles, fifth set above the plug	370	340
Jubilee cycle	387	337
Malachi, the last of the Old Testament prophets, may have seen the beginning of this cycle	393	——
Girdles, only one girdle joint marked	190	——
Jubilee cycle	187	137
North end of gallery, B. B. C.	0	0
Jubilee Passover after B. B. C.	13	13
Jubilee cycle	13	63

QUEEN'S CHAMBER.

From the north end of the gallery there is a horizontal passage leading southward to the queen's chamber. At 216 inches from the chamber the floor drops abruptly 18 inches. If the design of this drop was to indicate the near approach to the chamber, its distance, 5 times 43.2, might signify that the reign of righteous-

ness is at hand. The length of the chamber is 226.47 inches, or 4 times 56.5, the numeric symbol of house of God. The breadth is 205.85 inches, or 10 cubits, equal to 40 times 5.156 inches, that is, the holy discipline of The J H V. At the foot of the walls inside there is a ledge, round about, three or four inches wide; if the floor lining resting on this was about four inches

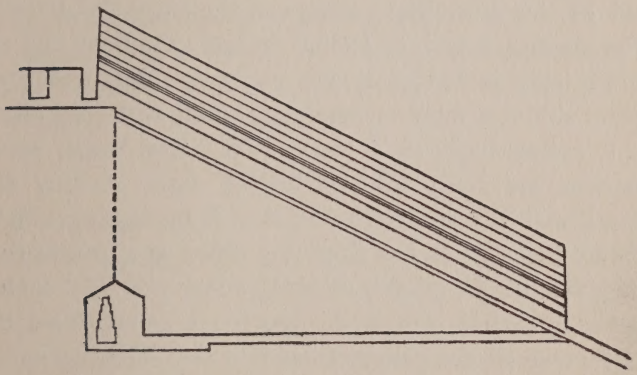


FIG. 64. ELEVATION OF THE QUEEN'S CHAMBER AND GALLERY.

thick, the height of the walls was 182.62 inches or one-half of 365.24. The vertex of the roof is three cubits, 12 times 5.156 inches above the walls. The slope of the roof is 239.93 inches, equal to 4 times 10.56×5.65, the numeric symbol of house of J H V of H V H.

The niche of five stages in the east wall is two cubits deep, equal to 8 times 5.156 inches. The heights of the successive stages, beginning with the lowest, are 67.14, 31.87, 28.23, 28.94, 27.70; the breadths are 61.80, 51.90, 41.83, 30.56, 20.30; the ascending diagonal of the lowest stage is one-fourth of 365.24 inches. The symbolic numbers, .565, 1.056, 5.156, and 12.96,

are integral factors of the measures of the niches. The floor line from the pavement outside the Pyramid to the centre of the niche is, as already stated, 5156 inches, the numeric symbol of The J H V.

THE GALLERY.

The gallery is a lofty room rising southward from the end of the ascending passage at the angle 26° 16′ 40″. The sloping length is 1883.6 inches; the floor line up to the step is 1815.5 inches and two cubits wide; on either side is a ramp or bench one cubit wide and about 22.6 inches high, or 4 times 5.65. The walls, seven courses, are built in overhanging laps, making the breadth of the roof two cubits and its sloping length 1838.6 inches. In the third lap there is a groove running the whole length of the gallery and 172 inches vertically above the floor. At 61.8 inches from the south end of the gallery there is a step 35.8 inches up from the floor; the vertical face of this step appears to be midway between the north and south base sides of the edifice; its height, 35.8 inches, equals 7×5.1056, Satisfaction of The J H V. In these measures and numberings of the gallery the symbolic seven prevails. The number of ramp holes on either side is 4 times 7, including the one on the step. The sloping floor is: Petrie 1815.5, Smyth 1814.8, equal integrally to $6 \times 43.2 \times 7$, which is the numeric symbol of a *cycle of consecrated peace*. The sloping length of the gallery is 1883.6 inches, equal to 365.25 times 5.156; that is, the *day* or *light* of The J H V. The length of the groove in the walls is 1866 inches, equal to $3 \times 4.32 \times 144$,

the numeric symbol of the *perfect consecration of man;* or taking 12.96 as the symbol of a cycle, 1866 equals 144×12.96, the Adamic cycle. The vertical height of the gallery being 339 inches (Smyth), and the angle of slope 26° 16′ 40″, the perpendicular distance between roof and floor is 303.9 inches, which is the diameter of a circle whose area equals that of the square of one-seventh of the sloping length of the gallery. In view of these coincidences by sevens, the gallery might be called the Hall of Peace, the Hall of Satisfaction, the Gallery of Glorified Manhood.

ANTE–CHAMBER.

This room leads to the king's chamber southward from the gallery. Its principal measures appear to represent the numbers 1296 and 365.24; the length is 116.26 inches, equal to $365.24 \div \text{Pi}$; the breadth is 5 times 12.96 inches. The floor is limestone except a granite block which rises above the limestone $2 \times .365$ inches. The north edge of this block is 12.96 inches inside the north end of the chamber, and its centre is 36.52 inches from the north end. The height of the room is 148.5 inches above this granite block, or 7.2 cubits, the cubit being the radius of the circle whose circumference is 129.6 inches. The east and west walls are lined with wainscot 108 inches high, or one-twelfth of 1296. In the wainscot of either side are three vertical grooves four inches deep and 21.6 inches wide, one-sixth of 129.6. The pilasters between the grooves are 5.8 inches wide, which is the diameter of the circle whose circumference is one-half of 36.524; 5.81 equals

one-thousandth of the geometric height of the Pyramid. The height of the lower course of the wainscot is about 43.2 or one-third of 129.6 inches above the granite block in the floor. Resting on this course, and let into grooves on either side near the north end of the room, is a granite beam, in two courses, about 16.5 inches thick and from 46.6 to 54.4 inches high; the south

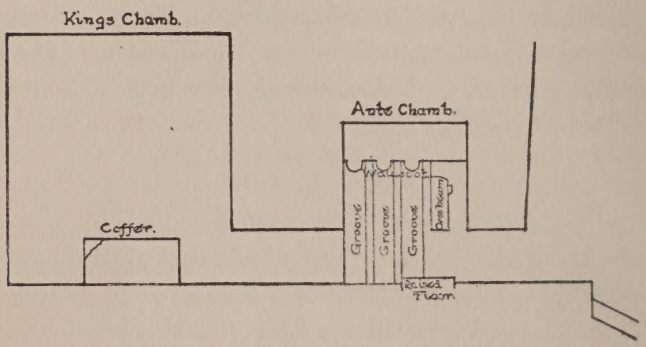


FIG. 65. KING'S CHAMBER AND ANTE-CHAMBER.

face of it is directly over the centre of the granite block in the floor; it is quite rough and unfinished except its southern face, and serves to give security to the wainscot of the east and west walls. In the wall of the south end of the chamber are four grooves 3.65 inches wide and about half a cubit apart. It thus appears that the geometric and ideal units of time that belong to the foundation lines of the edifice prevail in the dimensions of the ante-chamber.

THE KING'S CHAMBER.

This is a plain room, 10 cubits wide, 20 cubits in length, and 233 ± .5 inches high, ideally 2 times 116.25.

The north side is 330 inches, or 16 cubits from the face of the step in the gallery, and, as already stated, 5650 inches by floor-line measure from the pavement. The plan of this room is of two squares like the Holy Place of the Mosaic tabernacle, while its floor dimensions, like the tabernacle, are one-half of the Holy Place of Solomon's temple and Ezekiel's vision; each of its ideal squares is equal to the area of a circle whose diameter is 2 times 5.65 cubits, the numeric symbol of Son or symbol of H V H. Here, then, as elsewhere in the great edifice, time units appear in combination with the numeric forms of the Sacred Name.

THE COFFER.

The coffer in the king's chamber is a solid piece of granite in the form of a rectangular box; it has a ledge 1.7 inches deep, cut inside round about the top. The length in inches is, outside 89.62, inside 78.06; the breadth is, outside 38.50, inside 26.81; the depth is, outside 41.31, inside 34.42, including the depth of the ledge. It must have been set in place before the chamber was finished. In view of the symbolic features of the edifice, the coffer cannot be regarded as an exception. The following measures correspond to the ark of the Mosaic tabernacle: The inside area of the coffer, 26.81 by 78.06, equals the area of a circle whose diameter is 2.502 cubits, or the length of the ark, which was 2.5 cubits. The inside diagonal of the coffer is 4 cubits, or 2 times 56.5 digits. The depth of the coffer below the ledge is 32.72 inches, or 1.586 cubits, equal to 1.056 times the height of the ark, which was 1.5

cubits; that is, $1.056 \times 1.5 = 1.584$ cubits. The capacity of the coffer below the ledge is 565 omers, the omer being the Hebrew tithe of the large grain and wine measures, the ephah and the bath. Thus the numeric form of J H, J H V and H V H appear in the

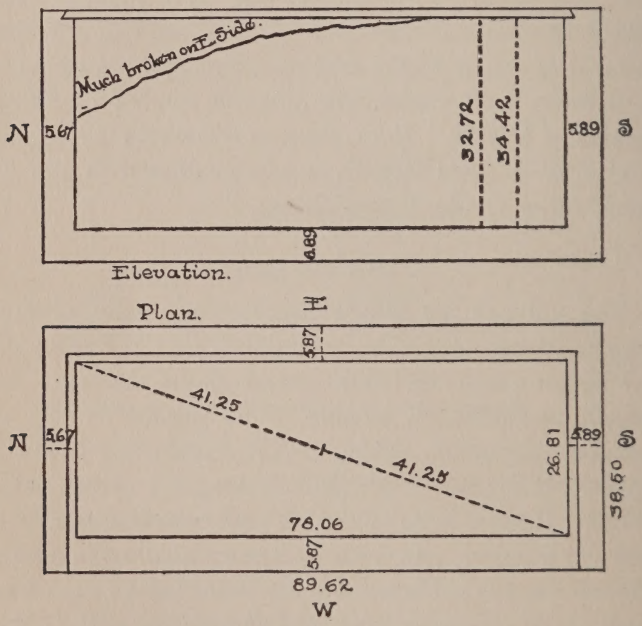


FIG. 66. THE COFFER.

ark and the coffer in cubit units, the numeric symbol of Divine sovereignty.

The date of the Pyramid, derived from the coincidence of the altitude of the entrance passage with the altitude of the pole-star Alpha Draconis, is 2170 B. C. or 2166 B. B. C. (*Smyth.*) "The epoch of Alpha Dra-

conis is either 2162 or 2176 B. C., according as we take the built part of the passage or the whole of it." (*Petrie.*) The mean of Mr. Petrie's dates is 2169 B. C. or 2165 B. B. C., which is 1165 years before the dedication of Solomon's temple; the numerical equivalent to 56.5 cubits is 1165.3 inches. The sidereal days in a sidereal year are 366.2567, and the diameter of a circle whose circumference is 366.2567 inches is 116.58 inches; hence ten times this number would be the numeric symbol of a full sidereal cycle; that is, 1165.8. The cubit being the symbol of Divine sovereignty, 56.5 cubits intensifies the cycle of sovereignty covering the interval between the Pyramid and the culmination of Hebrew nationality in the building of Solomon's temple.

The following items in Mr. Petrie's summary of interior positions will be of interest to those who wish to test many of the points herein presented.

Petrie's measure in inches :—	Horizontally from centre.	East from mid. line.	Above pavement.
Entrance passage		mid.	
Beginning	N. 4010.0 ± .3;	287.0 ± .8;	+ 668.2 ± .1
South end	N. 306.0 ± 2.0;	286.4 ± 1.0;	— 1181.0 ± 1.0
Ascending passage			
Beginning	N. 3016.3 ± .3;	286.6 ± .8;	+ 179.9 ± .2
South end	N. 1626.8 ± .8;	287.0 ± 1.5;	+ 852.6 ± .3
Queen's Chamber		side	
Mid. W. roof	N. .3 ± .8;	72.0 ± 3.0;	+ 1078.7 ± .6
Gallery floor		mid.	virtual
South end	S. 61.7 ± .9;	284.4 ± 3.0;	+ 1689.0 ± .5
Step top, face	S. .4 ± .9;	284.4 ± 3.0;	+ 1694.1 ± .7
Ante-chamber			
N. end floor	S. 113.7 ± .9;	Same?	+ 1692.6 ± .6
S. end roof	S. 229.8 ± .9;	Same?	+ 1841.5 ± .6
King's Chamber			
Floor entrance	S. 330.9 ± .9;	Same?	+ 1692.8 ± .6

Mr. Petrie's investigations confirm the geometric ideal of the monument. He says: "There are three great lines of theory throughout the Pyramid, each of which must stand or fall as a whole; they are scarcely contradictory and may subsist together. . . . . These are the Egyptian cubit theory, the Pi proportion of radius and circumference, and the theory of areas, squares of lengths or diagonals." On these same lines, as we have shown in Chapter VIII, the Egyptian temples were built as by an inspiration for the world's education in the beautiful, the true and the good. We may not be able to say how far Divine inspiration was concerned in the erection of the Mosaic tabernacle, the splendid Hebrew temple in Jerusalem, or the sacred palaces of Egypt; nor can we altogether exclude Divine inspiration from historic movements or any great work undertaken and executed in faith and in the fear and love of God, be it economic, religious, artistic, or a search for the deeper harmony of Nature's law, order and perfection. The symbolic use of numbers belongs to the earliest historical records. Ancient civilizations freely employed monumental forms as the best method to ensure the preservation of their records. The modern effort to interpret them has struggled against almost insuperable difficulties. The hieroglyphs of Egypt were unread by the most skillful archaeologists until the discovery of the Rosetta Stone, on which the same record had been inscribed in different languages, including the hieroglyphs and cuneiform characters. It was through a series of coincidences obtained by many years of study that the curious combinations of the

wedge-like characters were found to be letters of the Assyrian language. To this class of investigations belongs the vast array of numerical coincidences that occur in the lines and measurements of the Pyramid, touching astronomical, geodetic and historical facts. An explanation that attributes them to accident is not admissible so long as our judgment is under legitimate control. If, on the other hand, an explanation is based on the belief that the coincidences were comprised in the primary ideal of the edifice, directly or indirectly, the monument stands very close to the heart of prophetic forecast. If, however, the explanation rests upon the indisputable harmony of geometrical relations, astronomical data and numeric ideals, it is an acknowledgment that in ancient days a marvellous greatness was reached by students of human life and of the natural order of creation. Adopt whatever theory we will, no explanation of what has been discovered in the venerable pile can be satisfactory that attaches no weight to the symbolic use of numbers.

The value of a coincidence in nature, art, religion or history cannot be determined without taking account of the position it holds in the series to which it belongs. Human life is full of coincidences that are resultants of human and Divine activities working together; among these we may place the wonderful temples of ancient Egypt, the beautiful edifices and statues of classic art, and the masterful products of Hebrew and Christian ideals. All have felt the leaven of Divine inspiration. They have been great object-lessons in faith, visible symbols of truth, raised up to help men aspire to the

love and holy companionship of God; they belong to the Divine ideal of human education and development. In this view of a living copartnership between God and man the enfolding veil of mystery falls away from the Great Pyramid, and its numerical embodiment of Nature's harmony bears witness to the spirit of inspiration that belongs to human effort and history. It is written that Moses desired to see God's face; the answer came: 'It is impossible; go into thy closet, be hid from the world as in the cleft of a rock, reflect on what has already come to pass, and behold what God has wrought for the realization of His ideal of intelligent and loving companionship.' The Hebrew law-giver, filled with the wisdom of Old Egypt, felt the touch of Divine fire, and as he gazed upon the bush that was wrapped in a blaze of light, he beheld the future exaltation of his own people.

The 'Watchman' of the Pyramid, the Sphinx, in its sublime repose overlooking the desolated civilizations of the Orient, is a fitting symbol of eternal hope, which sees in the ascendant Star in the East a sure pledge of the victory that shall crown the splendor of human life.

CHAPTER X.

IDEAL METROLOGY IN HISTORY.

HUMAN activity may be compared to a solar system in which all things are held together by its central sun; nations are the planets wherein each individual life moves in its own cycle of endeavor. The balancing power belongs to the central orb, and each little globe is kept within controllable limits. Cycles of time come and go; conflicts and evil confusions have their day, but the Divine Goodness abides; there is no cessation of His love, and there is no step backward.

As the astronomer observes the changing position of a planet in the solar system, and thereby discovers the form of its orbit, so the historian reviews the cycles of civilization and endeavors to trace the Divine ideal that survives all sociological storms, and to see the hours of rampant evil close with a new sunrise. The great Orb of Life with progressive fullness presses forward towards a working companionship among men in anticipation of a growth into the likeness of its own splendor. Old Egypt felt the touch of inspiration and believed that her God would come in childlike form, grow to manhood, taste death, and then return to abide in her.

But the outspread wings reached far beyond Old Egypt, for inspirational energy is a world-wide possession, doing its work amidst the complex activities of human passion, will and perversity. Students of history realize that a rational comprehension of events depends upon a careful measure of cyclic developments in the relation of cause and effect. The activities to be measured are personal. They are represented by the leadership that attaches to great historical movements, in which personality is a controlling factor, and may be classed in three divisions — government, education, production. To formulate laws for their happy adjustment is the noble task of economics. Revolutions and revolts are the direct result of gross failure in the momentous work.

The earliest historial records show effort and failure. The code of Hammurabi, antedating Mosaic legislation by eight hundred years, and comprising the ethics of the Ten Commandments, was a great and noble work for righteousness. The codes of Confucius and Buddha were along the same line. But the true philosophy of beginnings is most concretely given in the Hebrew Genesis, showing that the human race is a product of Divine workmanship. Human liberty and Divine sovereignty stand face to face; they who endeavor to adjust themselves to the Divine order of things are called sons of God.

The subsequent record is clearly a witness to the continuity of the line of sons of God, including the patriarchal families of Seth, Enoch, Lamech, Noah, Abraham, Isaac and Jacob. The family of Jacob, after a period

of two hundred and thirty years in close contact with Egyptian civilization, was given a tribal nationality on the eastern coast of the Mediterranean sea, which culminated in the splendor of King Solomon, son of David. Four hundred years later the Hebrew government became so corrupt and deceitful that nothing less than a national overthrow could save the religious life of the people. This was effected by an invasion from the East, involving the destruction of the Temple and a large deportation of citizens to Babylonia. At the end of seventy homeless years the Hebrews were returned to their own land, but their national independence was forever lost. Through all their adversities family lines of descent were religiously preserved, in the belief that a prince should arise among them and restore their ancient glory. Of one of these lines Jesus of Nazareth was born.

Thus far Hebrew history is the story of great privilege and wasted opportunity; but the Divine ideal of companionship may be clearly traced in the historic drama. Foremost stood the sovereignty of God and the oneness of faith represented by one Tabernacle or one Temple for all Israel. Next to this was the solid brotherhood of Jews, in recognition of God's presence and protection. Within these limitations the Hebrew polity was built up and personal liberty allowed the greatest freedom. The processes in the development of the ideal, like those in nature, had a cyclical character, first in a patriarchal or parental government, then in a tribal confederacy, then in a consolidated nationality. Failure to appreciate the Divine ideal of companionship

resulted in national extinction. Thenceforth throughout their sad history the people did not lose faith: God was their abiding hope.

At thirty years of age, the time fixed by Hebrew law for a man to enter the priesthood, Jesus left his Nazarene home to identify himself with John's mission of reform, which had become widespread, and attest his right to leadership in righteousness. The record tells us that at his baptism a voice came from heaven saying, "This is My beloved Son." Thenceforth he declared himself the leader and standard of righteous living. He proved his right to leadership by works of beneficence, in which he showed that he had command of the products of land and sea and sky, of human life and the sanctities of religion. All this showed him to be a personal factor of no ordinary kind. He said of himself, 'I am come to give sight to the blind, to set free them that are oppressed.' He emphasized his personality in the highest degree, proclaiming himself Son of Man, Son of God. It was a year of evidences.

His next step was the choice of twelve men as personal friends and companions, to constitute a school of instruction in his ideal of righteousness. The fourth act in the sacred drama was his proclamation of the fundamental principles of his leadership:

1st. Blessed are the poor in spirit, for theirs is the kingdom of heaven; the basic plane of spiritual inspiration.

2d. Blessed are they that mourn, for they shall be comforted; herein is the generation of new life.

3d. Blessed are the meek, for they shall inherit the earth; herein is found the harmony of moral relations.

4th. Blessed are they which do hunger after righteousness, for they shall be filled; it is by this spirit that the eternal temple is built.

5th. Blessed are the merciful, for they shall obtain mercy; it is fundamental in the just administration of governments.

6th. Blessed are the pure in heart, for they shall see God; these are they that live in Divine light.

7th. Blessed are the peace-makers, for they shall be called the children of God; herein is the rest and satisfaction of holy love.

8th. Blessed are they that are persecuted for righteousness' sake, for theirs is the kingdom of heaven; it is the highway of life.

These eight elements are the foundation of true brotherhood, and express the sociological character of Christ's work. He presented them in beautiful symbolisms, so clear and true that the multitude went away saying, "Never man spake like this man." These eight notes in the ascending scale of his Beatitudes were in and of himself, a personal revelation of his own life, and the basis of the wonderful harmonies developed in the growth of his kingdom.

Throughout the remainder of his ministrations he kept close to his ideal, but with increasing intensity centering human thought and love upon himself. The common people, the producing classes, heard him gladly, and with growing confidence observed what he did

and said. By his sovereign command of earth, sea and sky, he met many temporal needs, but never failed to draw both minds and hearts to the spiritual life of the kingdom of God. With steady advance he reached the crucial hour of his revelations. It was in the synagogue at Capernaum where he openly asserted his pre-existence, and declared that his Father had sent him into the world to give men eternal life; that he himself was the true bread from heaven. To the Hebrew rulers his words appeared blasphemous, and many who had followed him turned away. The rulers were amazed, then they began to fear him, then to hate him, then to demand his death. But he went his beneficent way, revealing in word and deed the great pastoral work by which he purposed to rescue men from sin, illumine them with Divine light, and bring them into loving co-operation with God.

As hostility grew he ripened it and led the way for its satisfaction by repeating in the temple his claim to pre-existence, saying, "Before Abraham was, I am." With fixed purpose he put his life into the hands of them that hated him; for, as it appears in his great agony in Gethsemane, he could not hope to overcome the wickedness and hatred of the human heart, and establish his kingdom of righteousness among men, except he let them do with him whatsoever they would; the thirst for blood must be satisfied; then in the nature of things, men would see and hate their own wrong-doing, and a place would be found in their hearts for the inspiration of love. It was this kind of necessity for the reconciliation of man to God that made him

eager to reach Golgotha. So the great sacrificial act that crowned his mortal life was his own act, the supreme revelation of his love. As he hung on the cross, thrilled with the consciousness of his ultimate victory for righteousness, he took upon his lips that magnificent hymn of the Hebrew ritual beginning with "My God, my God, why hast thou forsaken me?" and closing triumphantly with: "All the ends of the world shall remember themselves, and be turned unto the Lord, ... For the kingdom is the Lord's, and he is the Governor among the people. .... They shall come, and the heavens shall declare his righteousness unto a people that shall be born, whom the Lord hath made." We may justly believe that the expression of his face in that moment was not in lines of physical suffering but of triumphant satisfaction. In his thirst for a righteous world he forgave them that slew him ignorantly, and breathed a blissful benediction upon his dying companion.

When the disciples had laid his body in the grave they thought all was lost. He had foretold his resurrection, but they did not anticipate it. So on the third day he began again to give proof of his right to leadership. They were slow to believe. After forty days of intercourse he was taken from them in the broad day: with eyes transfixed, they saw him pass within the veil of things unseen. Doubt still wrapped their souls with misgivings; but on the tenth day, when the inspiration which he had promised took possession of them, they realized within themselves that Light and Life and Peace had truly come.

Thenceforth the leadership of Jesus the Son of God was a living reality. It was a leadership they were to represent to all men. They were Hebrews, but they recognized Jesus as the Prince that should arise and restore to Israel all that had been lost. But more than this, they recognized him as the Prince who should re-create the world of human life in righteousness. To their mind he was the standard by which all sociological relations could be correctly measured. He was the only begotten of the Father, the Word made flesh, who in the beginning was with God and was God, without whom was not anything made that was made, in whom dwelt the fullness of the Godhead bodily. To them he was the one solitary personality that had the right to bring all things into his obedience, to whom all judgment was committed of things in heaven and things on earth. In this faith and by his command they made haste to show him to all men. They wrought as a forceful personality, enriched and strengthened in their devotion to Jesus by immediate results. Their work was a levelling up of human affairs to a high order of life, a Christ-like recognition of the Divine brotherhood of man. Selfish hostilities pursued them, but faith grew, persecution stayed her hand, and Christian faith became a controlling factor in European civilizations.

Now this standard of righteous living, Jesus, Son of God in human form and substance, was not given to men in a chance way; the soil had been prepared for it. When the time was fully come God sent his Son: in what did the preparation consist? To the Hebrew

people was given the high privilege of preserving and attesting the line of descent that should identify the Son of God with the JaHVe of the sacred covenant. It was given to them to forecast by religious life and ceremonial the immanence of God in the brotherhood of righteousness that should arise under the leadership of the Prince.

Meanwhile, outside of the Hebrew cult, the process of preparation had been going forward on a large scale. Far back in historic annals we find peoples of wonderful skill, knowledge and power occupying Egypt and western Asia. They were deeply religious peoples: marvellous monuments, which subsequent ages of degeneracy well nigh destroyed, still bear witness to their intelligence and devotion. The mystery of faith, exhibited in a high civilization, was their contribution to the world's growth.

Another enrichment sprang from the ancient Greeks, a race of ideal thinkers. The Greek schools sent their masters to Egypt and the East to learn science and philosophy. They returned laden with physical facts, and inspired with marvellous ideals veiled in the facts; this led the intense activity of the Greek mind to analyze and ideally reconstruct Grecian life. In language and art its products were most beautiful; Egyptian learning was the foundation on which the Greek did his best work.

After the Greek came the Roman arch that almost spanned the civilized world. Its great strength lay in its ideal of government. Sovereign unity was exalted above everything else. To rule the world was its su-

preme purpose. When Jesus was born Rome was invincible.

Thus far in history three supremacies had been developed, — religious mysticism in Egypt and the East, intellectual supremacy in Greece, and ideal sovereignty in Roman law. The Christian brotherhood grew to be a powerful factor in current affairs. Imperial power feared the results; destructive persecution issued from high places, but devotion to Jesus did not abate. In time the persecuting thirst was satisfied, and a cycle of hopefulness set in. The Greek mind with its keenest penetration seized the lofty ideals of Christian thought. Egypt with equal enthusiasm treasured the mysteries of Christian faith; but the religious life of Latin Christianity exalted the ideal of sovereign unity, and ecclesiastical supremacy became its dominant purpose. The old Roman ambition to rule the world took possession of the See of Rome; it was not less active than it had been in the Caesars. Under the excessive concentration of power in ecclesiastical affairs, the sense of personal responsibility declined in the heart of the people; just as the outlying provinces of old Rome had lost their interest in the republic when they realized that they could do nothing without an order from the Roman senate.

The inevitable issue of this state of affairs was moral stagnation. Ecclesiastical unity was kept well in hand save the schism between the Greek and Roman sections of the Christian household, but religious life was fast degenerating into superstitious and false beliefs. For the good of humanity and the betterment of righteous

living the stagnation had to be removed. Courageous and strong men, men of intense personality, saw the danger and became inspired. Through their preaching and controversy the Christian brotherhood as by a single blow was broken into fragments. The See of Rome strove in vain to mend the breaks. Great sections of the Church got free from ecclesiastical supremacy, and men began to think and to act with a keen sense of personal responsibility. The wildest flights of religious speculation were rife, yet personal devotion to Jesus was a persistent fact of the times.

The people who first took active part in this upheaval in mediaeval life were of Celtic origin, a race of freemen by nature. Germany, Switzerland, Holland and England became civil and religious battle-fields. Bloody wars followed in the wake of controversy. With zealous devotion to their ideal of Christian unity, the Roman pontiffs strove to maintain Roman supremacy, and bring all people to look to the chair of St. Peter for the adjustment of sociological differences. The leaders of English thought rejected the Roman ideal. They said they would have individual liberty and govern themselves; they got it, but the road to self-government was a rough one.

When religious reformation began in western Europe England was under regal control. From the beginning of English history two ideals had been in conflict,— the old Roman ideal of supremacy in government, and the Celtic ideal of personal liberty. Out of this conflict came English law, education and industrial growth, with a persistent effort to balance royal sovereignty,

and individual liberty. Centuries of experimenting passed and the balancing problem was not wholly solved. Old world traditions blocked the way. This was foreseen by the Great Engineer of human affairs, and he directed a new form of national activity to arise in a new world and make a new contribution to human weal. Five streams of emigration set out from the fatherlands to take possession of it; one of French origin on the St. Lawrence river; one of middle-class Englishmen on the shores of New England; one of Dutch extraction on the Hudson river; one of upper class Englishmen on the James river, and one of Spanish origin in the tropical south. The St. Lawrence colony was soon overshadowed by English settlers. The colonies that occupied the Atlantic coast maintained their local governments, but recognized allegiance to Great Britain. The rulers of Great Britain had not learned fully the art of governing happily. The unadjusted interests of their American colonies led to a war that resulted in the formation of a colonial confederacy independent of British authority. That war was a blessing, in that it compelled the colonies to put away their jealousies and unite as one man to face a common danger, and taught English rulers the need of a merciful administration of civil affairs. To pass from a confederacy to a solid nationality required the highest order of statemanship in the colonies. The transition was finally accomplished, the colonial confederacy ceased to be, and in its place stood the United States of America.

Another stream had been coming in from Africa; it was a forced current for industrial use. Under State

laws northern and southern sections alike profited by negro slavery. For a time it gave the nation no unrest, but in the enjoyment of their own personal freedom men of the north began to be inspired with a desire to extend this liberty to the negro slaves. Moved by this active personality one State after another abolished northern slavery. In the milder climate of the south the slave interest had a stronger hold. As years passed, the great western plains began to fill with a growing and active population. The right to extend slavery into the western territories was affirmed by the southern and denied by the northern States. Congress was full of the conflict. Negro slavery had become a perpetual menace to the peace of the nation. It had to be removed, but when and how? The James River ideal of sociological order and the Plymouth Rock ideal stood face to face in battle array. In the bloody conflict it was not the ideal of negro liberty that gained the victory, but the ideal of national unity against national disintegration. From a broad historic point of view this was of far greater importance than the abolition of negro slavery. The discordant element being removed, the United States of America was prepared to take a new place in the international life of the world. Great statesmen of intense personality set out upon the task of healing the bitterness that had grown out of the civil war: they reached a masterly success.

The other colonies southward, born of Spanish adventure, after three hundred years of a struggling existence, found themselves an oppressed people. The Spanish government ruled them for its own pleasure

and profit, and not with mercy. Repeated efforts to secure relief were fruitless. The Cubans looked to the United States of America for help. This was tendered first by friendly advice to Spain that she spare her Cuban subjects excessive taxation. The advice was rejected, and Spain was given the alternative — war. It was short and conclusive; Spanish navies were destroyed, and Spanish authority on the sea was wrecked, not only in the West but in the Far East. The United States was responsible for the results of the eviction of Spanish law. The Government at Washington had no choice; to it belonged the hard task of giving civil protection to the millions whom it had taken from Spanish control. The task was bravely shouldered; order was established, cities cleaned, fevers abated, and educational benefactions set to work. In a short time the Cubans began a new life of national independence and responsibility.

It is obvious that self-government, both national and individual, involves self-restraint as well as personal responsibility for what can be done to realize the Divine ideal of human fellowship. In this respect history is an object-lesson of supreme value, if in great historic movements and changes we perceive the lines of Divine workmanship. In the United States, even now, a regenerating process is going forward in accord with the Divine ideal. Races which for ages have stood in hostile array are so merged under beneficent laws and customs, that traditional enmities are well-nigh buried. Here men work and suffer together like brothers of the same homestead. It is ideal harmony somewhat real-

ized in economic relations. The spirit of brotherly companionship thus developed is going across the waters and finding a resting place in the heart of Eastern civilizations. Such is the Western world's contribution to human weal. All nations are feeling the breath of mutual helpfulness, and discovering that in the long run the highest prosperity is secured, not by a policy of selfishness, but by a graceful and merciful adjustment of relations in which people and nations can be helpful to one another. This is the leadership of Jesus. "He that will be greatest among you let him be your servant." Such is true life, worthy of the greatest effort a nation or an individual can make.

Ancient Greek philosophers taught their disciples that to know the truth of things they should not be content with a knowledge of the forms in which truth is veiled, but should seek to know the reason of the forms, and so come to understand the order of creation as a spiritual not less than a physical manifestation of the Divine mind. By a like method of research human history, under Divine leadership, becomes a progressive revelation of Divine perfections. The eternal ideal of harmony is declared in the beautiful relations which we find in the physical order of nature, but also in the complex personality of human life; and its processes of development admit of symbolic measurement analogous to that which appertains to the interpretation of Divine activity in nature.

The standard or prime unit of this measurement is given in the person of Jesus. It is only through his leadership that the Divine ideal of a working compan-

ionship can ever be reached. Now this leadership involves the ideals comprised in the symbolism of the cardinal numbers:

1st. The devout recognition of God as the supreme force and original fount of activity; this is fundamental unity, and its numeric symbol is one.

2d. Under the leadership of Jesus, sociological activities are begotten in the likeness of God's activity; this is reproduction, and its numeric symbol is two.

3d. Sociological relations begotten of this leadership are characterized by a likeness to Divine harmony and perfection; this is ideal harmony, and its numeric symbol is three.

4th. The upbuilding of personal relations and activities into permanent form is a temple for the use and habitation of God; this is ideal construction, and its numeric symbol is four.

5th. The reverent observance of the law given of God in Jesus Christ for the righteous adjustment of human affairs; this is government or sovereignty, and its numeric symbol is five.

6th. The periodic and progressive development of personal activity by successive advances towards Divine perfection; this is the cyclic ideal, time measurement, hence day and light, and its numeric symbol is six.

7th. Restfulness in action, contentment in serving, whereby the purpose and power to serve give increase to ability and contentment; this is ideal rest and peace, and its numeric symbol is seven.

8th. The immanence of God giving to nations and individuals a living inspiration to be, to act, to think

with God's thought and action; this is ideal life, and its numeric symbol is eight.

9th. United personal activity for the enrichment of human life and the maintenance of fraternal relations with all men; this is ideal brotherhood, and its numeric symbol is three times three, nine.

10th. The happy combination of all these elements of personal activity is ideal completeness in sociology, and its numeric symbol is ten.

These elements are at the foundation of sociological order, and national and individual righteousness. They were recognized by all ancient civilizations in the economy of national life, and in such recognition a high degree of stability, justice and personal liberty was secured. They are the footprints of the immanent Logos along the great cycles of time in which he led human life to receive the fullness of the Kingdom of Heaven. They were set forth in the Sermon on the Mount, and ever since the resurrection of Jesus, Divine Life Incarnate has given them a persistent vitality. Their complete and full realization can be found when the problems over which sin and righteousness wrestle for supremacy are solved to the satisfaction of Him who is the Way, the Truth and the Life. He inspired his disciples to look for such a consummation. The witnesses to his gracious work are multitude. His voice was in the burning bush, on the mount of Beatitudes and in the clouds of Sinai. In Hebrew and Christian history it goes deeper and deeper into the heart of humanity. Physical creation is not fragmentary, neither is human history. It is all a living unit. Human life

is a real factor in the vast throng of intelligences that people creation. It is set to serve some far-reaching purpose in the realization of the Divine ideal of companionship. Righteous living renders men consciously susceptible to the Divine touch. Speaking to God and to one another in the mighty throng is the way to know and to be known.

It is recorded of Moses that he desired to see God face to face. The answer was: It is impossible, but from a hiding-place in the rock he might look upon what had passed by. So in like retirement from the world's whir and strife we may look back upon what God has done. The marks of Divine leadership in Christian, Hebrew and remote Oriental cycles are uniform, the same handwriting throughout: love, righteousness, truth. The complex body of human personalities can build on this foundation and not be ashamed. The law of ultimate success is, work together with God. This makes possible a realization of the Divine ideal of eternal companionship. If we are appalled at the perverseness and wreckage of human life in the millenniums of the past, it is well to reflect that the greatest and most vital contribution man or woman can make to the Father of all souls is a bit of imperishable humanity on which through the aeons of eternity he may engage His skill and power to fashion it into the likeness of his own perfections. The earth, then, is the chosen breeding place of Divine Love. The cyclic phase of breeding times and seasons was recognized in very ancient civilizations. The period of 600 years was venerated as the proper time measure of great movements in

history. It is not far wrong. Starting at the birth of Christ and tracing events back to primitive beginnings, the first cycle of 600 years comprises the great Messianic prophecies of the Hebrew covenant; the second cycle covers the regal period of Hebrew nationality; the third cycle embraces their tribal vicissitudes from the day of their father Jacob; the fourth cycle touches the beginning of the postdiluvian age; the fifth comprises the era of Noah; the sixth, from 3600 to 3000 B. B. C., is contemporaneous with all the antediluvian families sprung from Adam, while the seventh cycle touches the beginning of Adamic life and of Egyptian and Oriental civilizations. The first cycle of 600 years in the Christian era may be termed the age of conquest; the second, the day of ecclesiastical supremacy; the third cycle, the day of religious liberation; while the fourth cycle may be anticipated as the day of Christian splendor, in which the kingdoms of the world shall become the kingdom of the Lord Christ, and governments will glory in the gift of righteousness and mercy. Life will then be within the King's chamber, and the brotherhood of man, so long a-hungering through the ages past, will be filled. The great solar cycle of 25800 years, or four quadrants of 600, will find its correspondence in the spiritual fullness of the reign of the Son of Man, Son of God. Who shall say that the cycles of the stars and of human life are not held in the one embrace of Supreme Love, "without whom was not anything made that was made"?

CHAPTER XI.

THE LIFE OF CHRIST IN SEVEN STAGES.

I. Preparation; until the day of his Baptism.
II. Personality; from his Baptism to his Sermon.
III. Law of the kingdom; from Sermon to John's death.
IV. Life of the kingdom; to final departure from Galilee.
V. Pastoral work; to the council to *kill*.
VI. Week of sacrifice; to his Death on the cross.
VII. Rest from conflict; to the Ascension.

THIS arrangement of events recorded in the Gospels is based upon the theory that the life of Jesus was definite in plan as well as in purpose. The chronological order here observed is that of St. John, in which the Logos ideal is logically unfolded along a line of events as they actually occurred. The arrangement in seven groups is given as a natural and comprehensive view of the progressive character of Christ's work and life, not however to the exclusion of other groupings, of which there may be many, yet all in harmony with one another. An obvious feature of this grouping is a symbolism corresponding to that of the cardinal numbers; thus the first period is the beginning, 1, of Christ's human life; the second period comprising the numeric ideals of 2, 3 and 4, is a witness of his sonship, 2, the harmony, 3, between himself and natural law, and his foundational, 4, work of evidences; the third division is a revelation of the inner law, 5, of his kingdom; the fourth division

comprises the seed parables symbolizing periodicity, 6, in spiritual growth; the fifth period is full of pastoral work in which the highest form of satisfaction, rest, peace and forgiveness, 7, is realized; the sixth is manifestly Christ's day of sacrifice, a revelation of high life, 8, in the Christ-world; and the seventh division closes with the Ascension of human life into the supreme companionship, 9, of heaven. A perfect chronological order of all the details may not be possible, but we trust that in the one here given there is no serious misplacement. The references, in columns, are to Matthew on the left of the page, to John on the right, to Mark and Luke between them.

I. Preparation. Baptism.

	Matt. Mark Luke	John
	Purpose of the record, 1. 1-4	
Immanuel	to be born of a virgin. (Is. 7. 14.)	
Mighty God	shall he be called. (Is. 9. 6.)	
	Elizabeth to bear John, 1. 5-25	
Jesus	to be born of Mary, 1. 26-38	
Son	of the Highest, of God, 1. 26-38	
The Word	was in the beginning with God,	1. 1-5
Incarnation	The Word was made flesh,	1. 14
Son of God	conceived of the Holy Ghost, 1. 18-24	
	Rejoicings, Mary, Elizabeth, 1. 39-56	
	John is born of Elizabeth, 1. 57-66	
The Highest	he shall be a prophet of, 1. 67-79	
Jesus	born of the Virgin Mary, 1. 25 2. 1-7	

	Matt.	Mark	Luke	John
A Saviour	is born to you, O shepherds,			
Christ	ye shall find in Bethlehem,			
The Lord	in a manger,			
Peace	on earth, good will to men,			
			2. 8-20	
A Hebrew	ancestry from Abraham,			
	1. 1-17			
Jesus	name in circumcision,		2. 21	
	Presentation in temple,		2. 22-38	
Salvation	mine eyes have seen,		2. 22-38	
Light	to lighten Gentiles,		2. 22-38	
Glory	of Israel; song of Simeon,			
			2. 22-38	
Redemption	Anna's prophecy,		2. 22-38	
The Star	on meridian of Bethlehem ?			
	2. 9			
The Child	seen by Wise Men,			
	2. 1-12			
My Son	escape to Egypt,			
	2. 13-15			
Nazarene	return from Egypt,			
	2. 19-23		2. 39-40	
My Father	I must do his business,		2. 41-50	
Growth	in wisdom and favor,		2. 51-52	

II. The Personality of Jesus. Evidences.

The Kingdom	of God is come. John's message,			
	3. 1-12	1. 1-8	3. 1-18	
Beloved Son	Heaven's testimony,			
	3. 13-17	1. 9-11	3. 21-23	
Son of God	line of ascent to God,		3. 23-38	
Son of Man	Jesus made known to Satan,			
	4. 1-11	1. 12-13	4. 1-13	
Son of God	came to be Son of Man,			1. 1-18

	Matt.	Mark	Luke	John
Lamb of God	John's testimony,			1. 19-34
Messias	Galileans' testimony,			1. 35-43
Son of God	Nathaniel's testimony,			1. 44-51
Supremacy	revealed in nature. Cana,			2. 1-11
	A few days in Capernaum,			2. 12
Supremacy	in God's house,			2. 13-25
Son of God	revealed to Nicodemus,			
Son of Man	" " "			3. 1-21
	Disciples increase,			3. 22-24
Son of God	John's testimony,			3. 25-36
	John imprisoned,		3. 19-20	
	Jesus departs for Galilee,			
	4. 12	1. 14	4. 14	4. 1-3
Messias	declares himself at Jacob's well,			4. 4-42
Supremacy	in sickness. Nobleman's son,			4. 46-54
Supremacy	foretold and fulfilled in Jesus,			
		1. 15	4. 16-27	
	conflict with unbelief,		4. 28-30	
	residence in Capernaum,			
	4. 13		4. 31	
Supremacy	in sea life, draught of fishes; he calls James, John, Peter and Andrew,			
		1. 16-20		
Son of God	demoniacs confess,			
		1. 21-28	4. 31-37	
Supremacy	in teaching and leading,			
	4. 23-25	1. 35-39	4. 42-44	
Supremacy	in leprosy, the symbol of sin,			
	8. 2-4	1. 40-45	5. 12-15	
Son of Man	in prayer,		5. 16	
Supremacy	in forgiving sin. Paralytic,			
	9. 2-8	2. 1-12	5. 17-26	
Supremacy	the right of leadership,			
	9. 9	2. 13-14	5. 27-28	
Son of God	his claim, in dispute with Jews,			5. 1-47

	Matt.	Mark	Luke	John
Supremacy	in spiritual things,			
	12. 1-8	2. 23-28	6. 1-5	
	men disbelieve, withered hand,			
	12. 9-14	3. 1-6	6. 6-11	
Son of God	Devils confess he is,			
	12. 15-21	3. 7-12		

III. THE LAW OF THE KINGDOM.

Leadership	school of instruction established,			
	10. 1-42	3. 13-19	6. 12-16	
Beatitudes	axioms of the kingdom, Sermon,			
	5, 6, 7		6. 20-49	
	The Beatitudes illustrated.			
Poverty	of spirit: the centurion,			
	8. 5-13		7. 1-10	
Sorrow	widow's loss of her son, 7. 11-17			
Humility	John's I must decrease,			
	11. 2-30		7. 18-35	
Hunger	for righteousness, kissing his feet,			
			7. 36-38	
Mercy	to two debtors and the woman,			
			7. 39-50	
	preaching in the villages, 8. 1-3			
Purity	demoniac made clean,			
	12. 22-37	3. 19-30	11. 14-26	
Purity	signs, Nineveh, repentance,			
	12. 38-45		11. 27-54	
Peacemaking	the brotherhood of man,			
	12. 46-50	3. 31-35	8. 19-22	
Peacemaking	selfishness condemned 11. 37-54			
Persecution	the 8th Beatitude. John in prison. Jesus			
	talks of persecution, 12. 1-59			
	A warning, barren fig tree,			
			13. 1-9	

	Matt.	Mark	Luke	John
Fruitfulness	the seed parables, to illustrate the germinating life of the Christ-world.			
	13. 1-53	4. 1-34	8. 4-18	
Faith	need of it, the tempest,			
	8. 18-27	4. 35-41	8. 22-25	
Faith	a help to healing, demoniac			
	8. 28-34	5. 1-21	8. 26-40	
Unbelief	rebuked at Levi's feast,			
	9. 1-17	2. 15-22	5. 29-39	
Faith	of Jairus, its fruit, a new life,			
	9. 18-26	5. 22-43	8. 41-56	
Faith	its fruit, a bloody issue healed,			
	9. 19-22	5. 24-34	8. 42-48	
Faith	its fruit, two blind men healed,			
	9. 27-34	6. 1-6		
Unbelief	its result, great loss,			
	13. 54-58	6. 1-5		
Faith	its fruit, many healed,			
	9. 35-38	6. 5-6	9. 1-6	
Faith	grows, Twelve sent to preach and heal,			
	10. 1-42	6. 7-13		
Unbelief	of people who heard John,			
	11. 1-24			
Unbelief	its result, John beheaded,			
	14. 1-12	6. 14-28	9. 7-9	

IV. The Life of the Kingdom.

Life	in feeding five thousand, a gift,			
	14. 13-21	6. 30-44	9. 10-17	6. 1-14
Life	saved, Jesus walking on the sea,			
	14. 22-33	6. 45-52		6. 15-21
Life	restored by healings,			
	14. 34-36	6. 53-56		6. 22-24

	Matt.	Mark	Luke	John
Bread of Life	Jesus said of himself,			6. 25-59
Unbelief	of Pharisees, they dispute,			
	15. 1-20	7. 1-23		
Life	secured by faith, the mother's plea,			
	15. 21-28	7. 24-30		
Life	abundant when sought,			
	15. 29-31	7. 31-37		
Life	renewed, four thousand fed,			
	15. 32-38	8. 1-9		
Life	impaired by unbelief,			
	16. 1-4	8. 10-12		
Life	feeble in thoughtless disciples,			
	16. 4-21	8. 13-21		
Life-light	human need, blind man,			
		8. 22-26		
Life-faith	Thou art the Christ,			
	Thou art the Son of the living God,			
	16. 13-20	8. 27-30	9. 18-21	
Life	by suffering,			
	16. 21-33	8. 31-33	9. 22	
Life	by way of the cross supreme,			
	16. 24-28	8. 34-38		
Life	eternal, in the Transfiguration,			
	17. 1-13	9. 2-13	9. 28-36	
Life	in prayer and fasting,			
	17. 14-21	9. 14-29	9. 37-43	
Life	only through death,			
	17. 22-23	9. 30-32	9. 43-45	
Life	in civil affairs, tribute given,			
	17. 24-27	9. 33		
Life	humble and loving, a little child,			
	18. 1-20	9. 33-50	9. 46-50	
Life	Divine is forgiving,			
	18. 15-35			

V. Pastoral Work.

	Matt.	Mark	Luke	John
A Missionary	final departure from Galilee,			
		10. 1	9. 51	7. 2-10
To Samaritans	Jesus' message,		9. 52-56	
Missionary spirit	helpful and unselfish,			
	19. 16-30		9. 57-62	
Pastoral work	seventy disciples sent out,			
			10. 1-16	
Pastoral work	among outcasts, ten lepers,			
			17. 11-19	
Pastor's life	in conflict with sin,			7. 1-52
Pastor's	mercy to accused woman,			8. 1-12
Pastor's	light in the world,			8. 13-59
Pastor's	light to man born blind,			9. 1-41
Pastor	knows his sheep, Good Shepherd,			10. 1-21
Pastor	a help in need, Good Samaritan,			
			10. 25-37	
Pastor's	visit to Martha and Mary,			
			10. 38-42	
Pastor's	joy, the seventy return,		10. 17-24	
Pastor's	instruction to pray,		11. 1-13	
Pastor's	rebuke to Jews,		12. 1-59	10. 22-39
Pastor's	preaching and admonition,			10. 40-42
Pastor's	benefaction,		13. 10-35	
Pastor's	fearlessness,		13. 22-35	
Pastor's	Sabbath lesson,		14. 1-11	
Pastor's	hospitality,		14. 12-24	
Pastor	finds lost sheep,		15. 3-32	
Pastor's	warning,		16. 1-13	
Pastor's	riches, Lazarus,		16. 19-31	
Pastor's	peacemaking,		17. 1-4	
Pastor's	fidelity and diligence,		17. 5-10	
Pastor's	advice to persevere,		18. 1-8	
Pastor's	humility, the publican,		18. 9-14	

	Matt.	Mark	Luke	John
Pastor's	wisdom, divorce,			
	19. 3-12	10. 2-12		
Pastor's	blessing, little children,			
	19. 13-15	10. 13-16	18. 15-17	
Pastor's	sympathy, death of Lazarus,			11. 1-6
Pastor's	pity, the rich ruler,			
	19. 16-30		18. 18-30	
Pastor's	encouragement, laborers of the vineyard,			
	20. 1-16	10. 17-31		
Pastor's	comfort, Lazarus raised,			11. 7-46
Pastor's	enemies, council to kill,			11. 47-53
Pastor's	refuge, country retirement,			11. 54

VI. The Day of Sacrifice.

	Matt.	Mark	Luke	John
Son of Man	shall be crucified,			
	20. 17-19	10. 32-34	18. 31-34	
Sacrifice,	not pre-eminence, for disciples,			
	20. 20-28	10. 35-45		
O Lord	have mercy on us, blind men,			
	20. 29-34	10. 46-52	18. 35-43	
Son of Man	come to save the lost, Zaccheus,			
			19. 1-10	
Sacrifice	in serving, parable of the pounds,			
	25. 14-30		19. 11-28	
Sacrificial	anointing at the house of Simon,			
	26. 6-13	14. 3-9		11. 55; 12. 11
Son of David	Hail, King of Israel,			
	This is Jesus of Nazareth,			
	Hosanna in the highest,			
	21. 1-11	11. 1-11	19. 29-44	12. 12-19
	Sleep and rest in Bethany.			
Traders	driven from God's house of prayer,			
Barrenness	A warning, withered fig tree,			
	21. 12-22	11. 12-26	19. 45-48	

	Matt.	Mark	Luke	John
Supremacy	defended, disputers silenced, 21. 23-27	11. 27-33	20. 1-8	
Two sons	Jesus describes the Jews' unbelief, 21. 28-32			
Husbandmen	wicked, the Jews' hostility, 21. 33-46	12. 1-12	20. 9-19	
King's son	his marriage, a prophecy, 22. 1-14			
Caesar's coin	a trap set by the Pharisees, 22. 15-22	12. 13-17	20. 21-26	
Traps set	by Sadducees, a lawyer and Pharisees, 22. 23-42	12. 18-37	20. 27-44	
Woes	to Scribes, Pharisees, hypocrites, 23. 1-3	12. 38-40	20. 45-47	
Sacrifice	true and real, widow's mite,	12. 41-44	21. 1-4	
Greeks	the philosophy of life,			12. 20-36
The temple	destruction foretold, 24. 1-22	13. 1-37	21. 5-36	
Sacrifice	for the coming of Christ, 24. 23-51			
Watch	for his coming, ten virgins, 25. 1-13			
Responsibility	for the use of talents, 25. 14-26			
Betrayed	by Judas at the world's price, 26. 14-16	14. 10-12	22. 3-6	
Passover	feast, a few things necessary, 26. 17-19	14. 12-16	22. 7-13	
Passover	meal, brotherly fellowship, 26. 20	14. 17	22. 13-20	
Footwashing	spiritual cleansing,			13. 1-20
Judas	treachery in the household, 26. 21-25	14. 18-21	22. 21-23	13. 21-26
Judas	leaves the passover meal,			13. 27-30

	Matt.	Mark	Luke	John
Lord's Supper	instituted,			
	26. 26-29	14. 22-25	22. 19-20	
Peter's	denial and offendings foretold,			
	26. 31-35	14. 26-31	22. 31-34	
Comfort	promised in the Holy Spirit,			14, 15, 16
Intercession	for unity and perfect life,			17
The Agony	Love's sacrifice,			
	26. 36-46	14. 32-42	22. 39-46	
I AM	the eternal name; the arrest,			
	26. 47-56	14. 43-52	22. 47-53	18. 2-12
Death	approved by the high priest,			
	26. 57-58	14. 53-54	22. 54-55	18. 13-16
1st denial	Woman, I know him not,			
	26. 69-70	14. 66-68	22. 56-57	18. 17
2d denial	I am not one of his disciples,			
	26. 71-72	14. 69-70	22. 58	18. 25-26
3d denial	I know not the man,			
	26. 73-74	14. 70-71	22. 59-60	18. 26-27
Compassion	the look of Jesus,			
	26. 75	14. 72	22. 61-62	
Son of God	I am; Jesus' reply to the high priest,			
	26. 63-64	14. 61-62	22. 67-70	
Sanhedrim	a selfish judge,			
	26. 65-67	14. 63-65	22. 71	
Judas	self-condemned, a slave's value,			
	27. 3-10			
Pilate	governor, power of life and death,			
Jesus	I am King of the Jews,			
	27. 11-14	15. 2-5	23. 2-3	18. 29-38
Pilate	shifts responsibility,		23. 4-7	
Herod	shifts it to Pilate,		23. 8-13	
Pilate	sees no fault,		23. 14-16	18. 38
Chief priests	crucify, crucify,			
	27. 15-23	15. 6-14	23. 18-23	18. 39-40
Pilate	take and crucify,		23. 24-25	

	Matt.	Mark	Luke	John
Soldiers	abuse Jesus,			
	23. 24-30	15. 15-19		19. 2-3
Crucified	Golgotha, third hour,			
	27. 32-38	15. 21-27	23. 26-33	19. 17-18
Cross title	Jesus, the Nazarene, King of the Jews,			
	27. 37	15. 26	23. 38	19. 19-22
1st word	Father forgive them,		23. 34	
2d word	to-day in Paradise,		23. 39-43	
3d word	behold thy Son, behold thy Mother,			19. 25-27
Darkness	from the sixth to the ninth hour,			
	27. 45	15. 33	23. 44	
4th word	Eli, Hebrew hymn, Love's triumph,			
	27. 46-47	15. 34-35		
5th word	I thirst, *i. e.* for heaven's glory,			
	27. 48-49	15. 36		19. 28-29
6th word	it is finished, the work given him,			
	17. 50	15. 37	23. 46	19. 30
7th word	Father, to thee I commend my spirit,			
			23. 46	
Burial	by Nicodemus and Joseph of Arimathea,			
	27. 57-61	15. 42-47	23. 50-56	19. 38-42
The Marys	prepare spices and rest on the Sabbath,			
		16. 1-4		
Sepulchre	sealed and watch set,			
	27. 62-66			

VII. The Resurrection and Ascension.

Resurrection	of Son of God, Son of Man,			
	18. 2-4			
Non-belief	women at sepulchre, tomb open,			
	28. 1	16. 2-4	24. 1-2	20. 1
Non-belief	Mary tells Peter, body is taken away,			
				20. 2
Angels	he is risen, see where he lay,			
	28. 5-6	16. 5-6	24. 3-8	

	Matt.	Mark	Luke	John
Non-belief	of disciples when told by the women,			
	28. 7-8	16. 7-8	24. 9-11	
Non-belief	of Peter and John, seeing where he lay,			
			24. 12	20. 3-10
Belief	Mary sees Jesus first, knows him,			
		16. 9		20. 11-17
Non-belief	of disciples as she tells them,			
		16. 10-11		20. 18
Non-belief	of disciples that the women saw Jesus,			
	28. 9-10			
The watch	reports falsely,			
	28. 11-15			
Non-belief	of two disciples going to Emmaus,			
		16. 12	24. 13-32	
Non-belief	when the two report seeing him,			
		16. 13	24. 33-35	
Frightened	when Jesus appears,			
		16. 14	24. 36-48	20. 19-25
Thomas	his doubt removed,			20. 26-29
New proof	required, Jesus eats,			21. 1-14
Command	feed my sheep, feed my lambs,			21. 15-25
Apostolic	commission,			
	28. 16-20	16. 14-18		
Jesus	seen of five hundred at once,			
	St. Paul's record, I Cor. 15. 6			
The Comforter	wait ten days for the Comforter,			
			24. 49	
Witnesses	ye are my witnesses,		24. 48	
The Ascension	the Son of Man glorified,			
		16. 19-20	24. 50-53	

E., Equinox, Mch. 21, Sept. 21; S., Solstice, June 21, Dec. 21.

B. C. 5; New Moon, May 23; Jerusalem, Gabriel to Zacharias.
E. 5; New Moon, Sept. 19; Judaea, Elizabeth favored.
E. 4; New Moon, Mch. 26, Nazareth, Gabriel to Mary.
S. 4; New Moon, June 22; Judaea, John born.
S. 4; Full Moon, Dec. 30; Bethlehem, Jesus born Dec. 25.
B. C. 3; Jan. 26, 9 P.M.; Transit, Jupiter, Moon; Star of Magi.
E. 3; Full Moon, Mch. 28; Egypt, sojourn of Holy Family.
E. 2; Full Moon, Sept. 11; Nazareth, return from Egypt.
A.D. 10; Full Moon, Mch. 19; Jerusalem, Jesus and Doctors.
S. 27; New Moon, June 21; Judaea, John preaching.
S. 27; Full Moon, Dec. 30; Bethabara, baptism of Jesus.
28; Full Moon, Feb. 26; Cana, beginning of Miracles.
E. 28; Full Moon, Mch. 27; Jerusalem, I Passover, traders.
S. 28; Full Moon, June 23; Judaea, Jesus revealed.
28; Full Moon, Nov. 7; Samaria, Jesus the Messias.
S. 28; Full Moon, Dec. 17; Galilee, Jesus revealed.
E. 29; Full Moon, Apr. 16; Jerusalem, II Passover.
S. 29; New Moon, June 27; Galilee, Jesus revealed.
E. 29; New Moon, Sept. 25; Galilee, Beatitudes, Sermon.
S. 29; New Moon, Dec. 21; Galilee, Beatitudes illustrated.
E. 30; Full Moon, Apr. 5; Galilee, III Passover, unattend'd
S. 30; Full Moon, June 30; Decapolis, etc., feeding thousands.
30; Full Moon, Aug. 26; Galilee, Transfiguration.
E. 30; Full Moon, Sept. 11; Galilee, final departure.
30; Full Moon, Oct. 12; Jerusalem, Tabernacles.
30; Full Moon, Dec. 9; Jerusalem, Dedication feast.
31; Full Moon, Jan. 7; Ephraim, retirement.
31; Full Moon, Mch. 24; Jerusalem, the Lord's Supper.
E. 31; Full Moon, Mch. 24; Jerusalem, the Crucifixion.
E. 31; Full Moon, Mch. 24; Jerusalem, the Resurrection.
31; New Moon, May 7; Bethany, the Ascension.

CHAPTER XII.

VISIONS OF THE CHRIST-WORLD

SEEN BY A HEBREW PROPHET IN HIS CAPTIVITY AND A CHRISTIAN PROPHET IN HIS EXILE.

THE VISION OF EZEKIEL.

THE Hebrew Commonwealth reached the zenith of its glory in the reign of King Solomon, whose crowning act was the erection of a gorgeous temple, 1004 B. C., to the worship of Jah, Jahve or Jehovah, the Lord God of Israel. Four hundred years later, because of the wickedness and tyranny of its government and rulers, the city of Jerusalem was taken by the king of Babylon, and many thousand people were carried into captivity.

In the 25th year of the Captivity, and 565th year before the Incarnation, a vision of the New Jerusalem, or City of God, was revealed to a captive prophet. It is given in the 40th and following chapters of the Book of the Prophet Ezekiel. The description is in architectural forms and measures, presenting, in the language of numeric symbolism and Hebrew ritual, the Kingdom of Righteousness, the Christ-world.

The belief that the Vision was a prophetic forecast of the Christ-world is based upon the vast influence set

forth in chapter forty-seven as waters proceeding from the temple in the midst of the city, and going out at the east gate ankle-deep, knee-deep, thigh-deep, and lastly, swimming-deep, for the healing of the nations.

St. Paul, a Hebrew of the Hebrews, and thoroughly versed in Hebrew thought and literature, speaks of the Christ-world as a building fitly framed together, a temple of living stones. The form of Hebrew ritual stood for what could not be seen. Teachers and people were brought up in it from childhood. The prophet Ezekiel knew well the temple and all its appointments, and could readily follow the intricate measures detailed in the Vision. To the poetic mind of the Hebrew as to all Oriental peoples symbolic instruction was most attractive.

The importance of the revelation is indicated by the solemn words of the angel, "Son of man, behold with thine eyes, and hear with thine ears, and set thine heart upon all that I shall show thee; for to the intent that I might show them unto thee art thou brought hither: declare all that thou seest unto the house of Israel."

The angel held in his hand two measures, one a reed or pole of six cubits (ten feet three and three-fourths inches), and a line of flax, the length not given. The cubit of the Vision is 20.625 inches, and the reed is six cubits. The cubit is the prime unit of measure in the Vision, as it was for the Mosaic Tabernacle, the Temple at Jerusalem and the sacred vessels connected with them; hence its symbolism is an important feature of the revelation (see Chapter V). The Vision being a spiritual forecast and definitely measured in every part,

we may justly interpret its measures as symbols of things spiritual in the Christ-world.

The general plan of the city comprises a central or inner court, 100 cubits square within a pavement 50 cubits broad, outside of which is a court 100 cubits broad

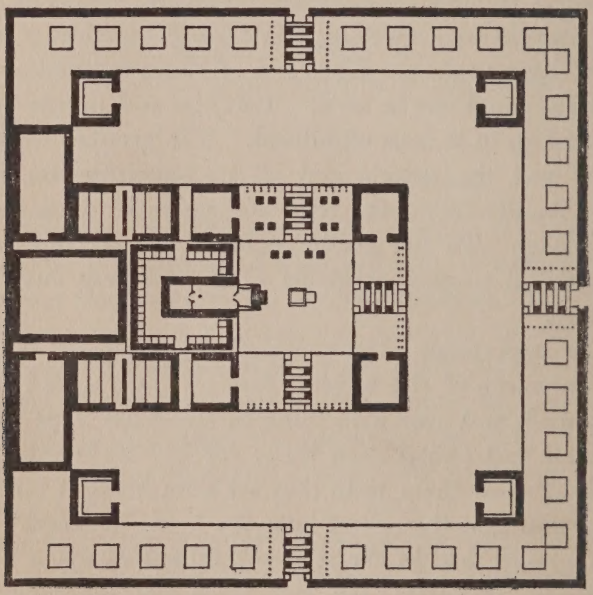


FIG. 67. GENERAL PLAN OF CITY.

round about, and enclosed by a lower pavement 50 cubits wide; the whole is surrounded by a wall six cubits thick and six cubits high. Midway on the north, south and east sides of this wall is an entrance gateway of seven steps crossing the lower pavement; corresponding to each gateway there is an inner gateway of eight steps, crossing the upper pavement and leading

up to the inner court. The city being 500 cubits square, and the wall round about it being six cubits thick, the outside measure of the wall is 512 cubits, equal to 10 times 1056 inches, which is the numeric symbol of the fullness of J H V. As the hills stand round about Jerusalem so standeth the Lord round about his people; this is what we take the measure 512 cubits to signify.

The area of the city, 500 cubits square, is equal to that of a circle whose diameter is 565 cubits, that is, the city of H V H, 565. Nearly all the measures of the courts and buildings are by multiples of 5 or 6; thus by number and by measure the name H V H is there. Each of the three wall openings is 13 cubits long, that is the numeric form of A L, God. (See Chapter III).

The three groups of gate buildings which extend across the lower pavement, are each 24 cubits broad and 50 cubits long; their construction inwardly is by alternate measures of 6 and 5 cubits, the two porches being connected by a step-like walk 8 cubits broad within a border or fencing of 10 posts on either side, each post being one cubit square. On either side of this walk are three chambers or stations 6 cubits square, separated from one another by a space of 5 cubits. Between these chambers and the posts there is a space of one cubit, thus making the breadth 24 cubits. But each post and chamber has cornices round about, called arches, projecting one-half a cubit; hence the roof-measure of the breadth of the gateway is 25 cubits, as given in the text.

The three outer gates are of one pattern; the people may go in at the north or the south gate, but the east gate is reserved for the Prince, He only can go in by it. High up in the inner court stands the Great Altar of Sacrifice, with its steps facing the gate of the Prince. The way before Him is His way. With this sugges-

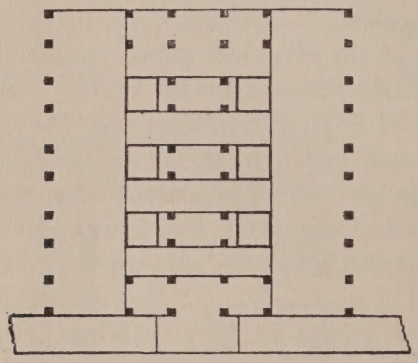


FIG. 68. OUTER GATE AND WALL.

tion in mind, we ask what can the measures of the gate signify?

The alternate measures of 6 and 5 cubits indicate that the entrance into the Kingdom of Righteousness is the way of God. The clear passage between the border posts is 8 cubits, that is, the way of life. The border or fencing of 10 cubit posts on either side indicates that the way of life is under the protection of the law and sovereignty of God. The 7 steps tell us that it is the way of peace and Divine forgiveness. The guard chambers, or Divine Triad, keep perpetual watch over them that enter therein. The little windows,

under the brow-like cornice, as the eyes of God, stand for our comfort and safe-keeping in the solemn act of renouncing the world, the flesh and the devil. The chambers are the exact measure of the enclosing wall, 6 cubits — 2 times 3 — the likeness of God.

The inner gates are of the same pattern as the outer gates. They are set on the upper pavement opposite the outer gates. This pavement being one step above the outer court, its gates have 8 steps instead of 7. As these gates lead to the Court of Sacrifice, 8 steps here indicate the life of sacrifice that is appointed God's people.

On the lower pavement beside the entrance gates the Vision shows a post of threescore cubits, not a row 60 cubits in length, but a border, fencing or boundary consisting of 60 cubit-posts; for where length, breadth or height is intended by a number it is so qualified, but where number only is indicated the qualification is omitted. These cubit-posts being assigned to three entrances, each gate has a fence or boundary of 10 cubit-posts on either side, enclosing a court for each gate, and separating it from the residential portion of the pavement where 30 chambers of abode are set. On the upper pavement each gate has a setting of 10 posts on either side, 25 cubits long and 5 cubits broad. The whole number of cubit-posts is threescore. These posts have pediments, called arches, forming a double colonnade with its side facing the outer court, to screen off the interior of the pavement devoted to sacrificial use. This arrangement by number may represent the ten commandments of the law, admonishing both priests

and people that the sacrificial appointments of the Christ-world must be reverenced.

The place for slaying the sacrifices is fixed by Hebrew law at the north gate. This order is observed in the Vision. Eight tables are set, two on either side of the outer porch of the gate and two on either side of the inner porch. Eight being the symbol of Life, this appointment indicates that in the Christ-world life is given by means of sacrificial death, which is the highway of spiritual life. The appointment of eight tables, like that of eight steps in the inner gate, is a fundamental recognition of sacrifice. Special notice is taken of a place near the tables where the offerings for sacrifice are cast down; it is the penitential attitude of God's people who, poor in spirit, draw nigh to offer themselves.

Between the inner porch of this gate and the Great Altar are set four tables of hewn stone, on which are laid the burnt offerings symbolic of complete self-oblation. This supreme act of devotion belongs to the economy of grace, and brings us close to the Great Altar, the supreme manifestation of Divine love, which can be reached only on the east side, by steps facing the gate of the Prince. The base on which this Altar stands is 16 cubits square and 1 cubit high, surmounted by a platform 1 cubit high and 14 cubits square. The Altar itself is 4 cubits high and 12 cubits square, with a border round about, 1 span wide. The platforms have borders or fenders half a cubit high, joined at the corners by low posts which, with the borders, must be sprinkled with blood by the officiating priest. The

fenders guard the Altar from approach save by the steps on the east, the way of the Prince. The final act in the order of sacrifice is the ascent by the steps and the solemn placement of the offering upon the Hearth of Divine Love.

The spiritual interpretation of these measures does not appear difficult. The base, 16 cubits square, comprises four squares of 8 cubits, that is, the altar of life; the platform of 14 cubits square comprises four squares

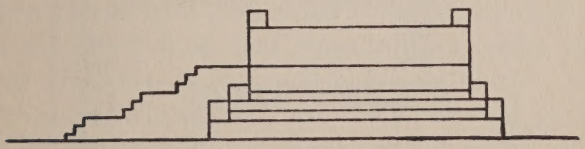


FIG. 69. GREAT ALTAR.

of 7 cubits, that is, the altar of peace; the altar itself, 12 cubits square, comprises four squares of 6 cubits, that is, the altar of (3 times 2) Divine Sonship. The altar in two parts may represent the union of the human and the Divine, while the border on the top, one span, equal to 3.65×3 inches (see Chapter V), is a symbol of the day, glory, light of God. Here then rests human life on God's hearth-stone, in satisfaction of Divine love to man and human love to God. It is a vision of the victory of righteousness in the Christ-world.

On the western border of the Court of Sacrifice stands the Holy Temple, the symbol of the Divine Presence, within a court 100 cubits square. The front of the temple is 32 cubits broad, that is, 4 times 8, the temple of life. The walls are 6 cubits thick, that is, 3

times 2, Divine Sonship. The building bears in every part the symbol of victory, the palm tree between two cherubs, one having the face of a lion, regal power, the other a human face, manhood. This triplex witness appears on all the posts in the city.

In front of the Temple is a porch 20 cubits long and 11 cubits broad; on either end is a row of 5 cubit-posts, called the post of the porch, 10 in all, the symbol of the commandments, while on the front of the porch is the gate 3 cubits broad on either side, thus leaving a space of 14 cubits for the steps, that is, 2 times 7, son of peace. At either end of the porch is a column corresponding to Jachin and Boaz in Solomon's temple, which may represent the two witnesses mentioned in the Vision of St. John, that is, the Hebrew and the Christian Testimony. These pillars are not described, except that they are 6 cubits square and bear symbolic cherubs and palm trees. They do not serve as supports to a roof or pediment and may therefore be regarded as purely monumental.

The Temple itself is the most sacred place in the Vision; it is the veil of the Divine Presence. We have already noted the walls and their decorations. The entrance door is 10 cubits broad, and two-leaved, bearing the symbolic cherubs and palm trees. The floor plan inside is of two parts, the Holy Place and the Most Holy. The Holy Place is 20 cubits broad and 40 cubits in length; that is, two squares, 20 cubits each. The square represents possession or abiding place, and 10 times 2 stands for complete and perfect sonship; hence the Holy Place signifies the home of

full and complete sonship in communion with the Divine Presence.

The Most Holy Place is 20 cubits square, the area of a circle whose diameter is 4 times 5.65, house of God. It contains no table, altar or any visible thing. It belongs exclusively to the Divine Presence. The measure indicates this. Being 20 cubits square, the sum of the

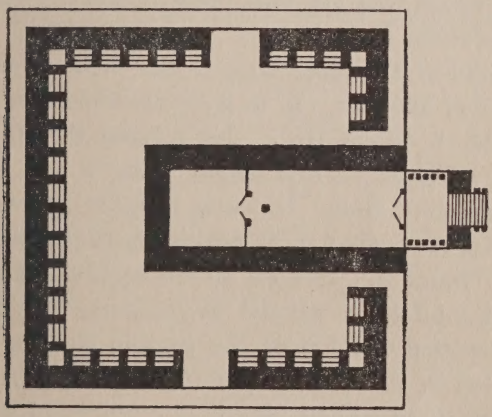


FIG. 70. THE TEMPLE AND SIDE CHAMBERS.

two diagonals which intersect in the form of a cross upon its floor, is 56.5 cubits, the numeric form of H V H. So the cross of perfect sonship is a permanent feature of God's most sacred abiding place. It is the rest of Him who was offered for us a whole burnt offering, who rose again from the dead and ascended into Heaven.

The Most Holy is separated from the Holy Place by a screen or veil, in the midst of which is set a two-leaved door, 7 cubits broad, signifying the rest of God. But the door is described as a door of 6 cubits, that is,

each leaf contains 3 cubit-bars; for here, as elsewhere, if length, breadth or height be not specified, number only is indicated. These bars bear the symbolic cherubs and palm tree. Outside of the door, on either side, stands a cubit-post, the ever-present symbol of Divine Sovereignty, with the symbolic cherubs and palm tree. Between the posts and on either side there is a space of 6 cubits, which with the two posts makes 20 cubits, the breadth of the Holy Place.

In front of the Most Holy is the table of the Lord, or altar of incense. It is 2 cubits in length on every side, and 3 cubits high. Its volume therefore is 12 cubits. The length and height being 2 and 3, it represents sons of God. Its cubic measure or containment being 12, it stands for the covenant, 12, or building of God, 4 times 3. Incense is the symbol of worship; hence the table, by use and by measure, is symbolic of the perpetual worship of the sons of God in covenant with God in the midst of the Christ-world. This table is of live wood and represents the vitality of the adoration that is given him in the Temple of his Most Holy Presence. The whole interior of the Temple walls bears the same life-symbol; it is ceiled with wood upward even to the little windows above. Elsewhere, save the tables of hewn stone, the material of the city is not named. We have but one inference to draw from this: it is a spiritual city, of living humanity, eternal in the heavens, whose maker and builder is God.

The court in which the Temple stands is 100 cubits square. The outer dimensions of the Temple being 32

by 66, a space is left on the north, south and west sides 34 cubits broad. Along the outer edge of this space a walk or ambulatory is left, 5 cubits broad. Just inside the walk is a wall 5 cubits thick, and inside of this wall are 30 chambers 4 cubits broad and 6 cubits high, containing 3 tiers of benches, one above another, within which is a wideness of 20 cubits round about the house.

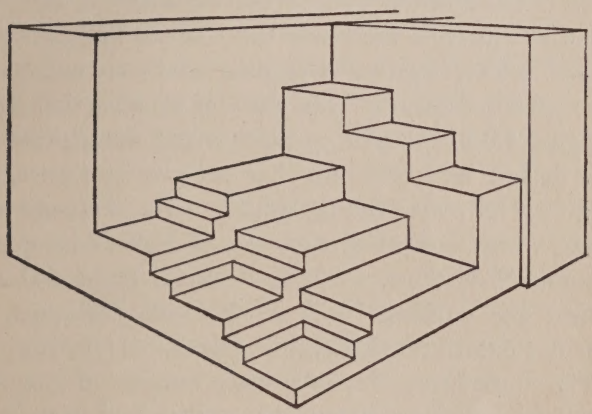


FIG. 71. SIDE CHAMBER.

A door or opening is on the north and south sides leading from the inner court of the chambers to the walk outside. The chambers bear the symbolic cherubs and palm tree. The whole arrangement indicates a place of retirement, a retreat, where, under the very walls of the Temple, the priests, who are to serve in the Holy Things, shall prepare themselves for their solemn duties. This is as it ought to be with them that are entrusted with the mysteries of God. The measure of each side chamber is 4 cubits deep and 6 cubits high; that is, 4,

building or house, and 2 times 3, Son of God; thus the chambers represent the priesthood of the house of the Son of God; as Christ said, I appoint unto you a Kingdom, and lo, I am with you alway, even unto the end of the world.

A spiral stair-case to reach the three tiers of the chambers does not appear to be architecturally practicable. The construction of the chambers is described as an ascent from the lower tier "to the highest by the midst" which involves a turning and "an enlarging" or extension outward. The form of construction shown in figure 71 is thought to answer the description; by this design each chamber has its own entrance, and each tier its own winding ascent. The foundation or house, which comprises each set of tiers or benches, is 4 cubits from front to back, 6 cubits high, and rests against the enclosing wall of 5 cubits thickness, but does not enter into that wall. (Ezek. xli: 6, 7.)

The ambulatory, 5 cubits wide outside of the little chambers, connects with galleries that lead to the large chambers where the priests eat the Holy Things. These chambers are placed north and south of the Temple court, but somewhat westward. They are each 100 cubits in length outside from east to west, and 50 cubits broad. The floors of each are in two sets of platforms facing one another, one set being placed towards the north wall of the chamber, and the other towards the south wall. At the foot of each set of platforms is a walk 10 cubits broad, with a separating curb of one cubit between the two walks. The doors of the chambers open into galleries on one side, and

into the outer court on the other side. The thickness of the walls is not given, but since they enclose what is set apart for use of the priests, they may be 5 cubits thick, the same as the wall that encloses the little chambers, alcoves or benches, in the Temple court.

The symbolism of the two large eating chambers does not appear difficult. The spacious plan of platforms, steplike, one above another, suggests provision for assemblies of men brought together for instruction. To eat Holy Things means to read, mark, learn and inwardly digest sacred truth. These chambers therefore may stand for schools of the prophets in the Christ-world. The order of three platforms may represent three grades of workmen; namely, superintendents, skilled workmen, and helpers — a classification necessary in organized work, of whatever sort it may be, whether ecclesiastical, industrial, educational or otherwise. This threefold order is not confined to the eating chambers of the priests. The three tiers of little chambers in the Temple court, and the provision of 30 residential chambers on the lower pavement, bear the same symbolic value.

Next west of each large eating chamber is an apartment where food is prepared for the priests. These preparation rooms may well represent elementary schools to fit men for the holy work of ministering in the Christ-world. The large eating chambers tell us that men who serve in holy things must never cease to study the Divine Word. The education of the priest of God is never finished. Also in every corner of the outer court

there is a place 30 by 40 cubits in which the priests prepare food for the people. The area is 1200 cubits, that is, 100 times 12, all the covenant in the four corners of the earth.

Between the Temple Court and the wall on the west of the city is an area 100 cubits square. It contains an enclosure 90 cubits long and 70 cubits broad within a wall 5 cubits thick. It has no door of entrance or exit. All other buildings described in detail have doors; this has none; it is the Separate Place. The spiritual character of every other part of the city precludes the suggestion that it can be assigned to any gross or earthly use. The thought that it is a place for the refuse of animal sacrifices is utterly repulsive to the spirit of the Vision. We may have a clue to its purpose in the measures 70, 90 and 5. In numerical symbolism 5 signifies what is appointed. The number 70, or 10 times 7, signifies the fullness of rest, while 10 times 9 represents the brotherhood of the Christ-world. Thus interpreted, the Separate Place indicates that God has appointed a place of rest for all His people. Can this be other than the rest of Paradise?

OUTSIDE THE CITY.

The city is set in the midst of a series of squares, the first being an enclosure 3,000 cubits square, which is 100 squares of 30, the likeness of Plato's cycle of Divine perfection comprising 100 cubes of 3; the second is 4,500 measures square, that is, 9 squares of 500 on a side, which is brotherhood; it has 12 gates according

to the number of the tribes of Israel; and the third is 5,000 measures square. Adjoining this square on the east and on the west are two squares, 5,000 measures each, 4 squares for the Prince. The whole measure from east to west is 25,000. North of this is an area

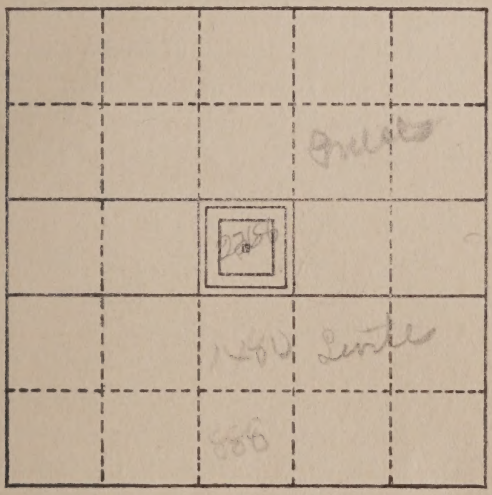


FIG. 72. THE OBLATION.

10,000 broad and 25,000 in length; it is equal to 10 squares measuring 5,000 on every side. This portion is for the priests. A like portion is on the south side of the city for the Levites. These three portions, for the Levites, the priests, and the Prince, constitute a possession 25,000 measures square, with the city square in the midst. It is the Holy Oblation, that which is reserved for the Temple worship. It cannot be sold or exchanged. A square of 5,000 is equal to the area of

a circle whose diameter is 5,650, that is, a possession of the fullness of H V H.

Northward of the Oblation are seven portions each 10,000 broad and 25,000 in length from east to west, and southward of the Oblation are five like portions. The whole, including the Oblation and the city, consists of 145 squares, measuring 5,000 on a side. As an area it represents the possession of God's people,—144 squares, with the city square in the midst. The number 144 is that given in St. John's vision by thousands, to denote the sealing of the 12 tribes; 12 thousand for each tribe. St. John's numbering is in the likeness of a polling census, while Ezekiel's is of a land census, but they symbolize the same thing — the people of the Holy Covenant. The whole is a forecast of the triumph of God's people in the Christ-world; they shall multiply as the sands of the sea, and shall have the whole earth for their possession. The spiritual power that proceeds from the Holy Temple and goes forth at the east gate, ankle-deep, knee-deep, thigh-deep, swimming-deep, for the healing of the nations, will be satisfied with its fruition when the sovereignty, love and mercy of God are everywhere recognized, and all people worship at the feet of the Holy One of Israel. By number and measure God declares Himself in the wonderful setting and movement of the stars, in the physical order of creation, and in the prophetic forecast and activity of human life. "Son of man, behold with thine eyes, and hear with thine ears, and set thine heart upon all that I shall shew thee."

THE VISION OF ST. JOHN.

Two Revelations of the Christ-world were given in ancient days, one to the prophet Ezekiel in the year 565, before the Incarnation; the other to St. John in the latter part of the first century A. D. The records of these Visions have come to us substantially as they left the author's hand. They present remarkable differences. Ezekiel's shows the order and spiritual life of the Christ-world; St. John's its struggle and suffering. Ezekiel's is given in architectural forms, symbolic measures, and the ancient Hebrew ritual; St. John's shows the movements of conflicting forces in symbolic forms drawn from the natural world. Ezekiel's is calm, majestic, symmetrically beautiful, and fraught with the rest of Divine repose; St. John's is all astir from the beginning to the end. In Ezekiel's the progressive and final victory of righteousness is shown in the ever-present and silent palm tree; in St. John's it is shown in the short and jubilant song of great multitudes. In Ezekiel's we see the manifestation of the Divine Presence in the midst of reverent and holy worship, as in a vast cathedral of world-wide interests, where ceaseless devotion and the harmony of faith forbid strife before the Holy Presence; in St. John's we see the clash of arms, — the world, the flesh and the devil in conflict with the cross of Jesus.

The Vision of St. John is the last book of the Holy Scriptures, a forecast of the tribulation and victory of the Kingdom of Christ, and the adoration given Him by the faithful. No small part of it is presented in

numerical terms. In all ages of Christian faith the symbolism of this Revelation has engaged the attention of the best Biblical students. Some have followed one, and some another theory of interpretation, but that which seems to have received the greatest favor is, that the numerals used represent definite periods, or dates, of time, in Christian history. Great effort has been made to fix dates to the beginning and ending of the periods, but the results are open to criticism, and at the best they are but partially satisfactory.

The theory followed here is quite different. Numbers are not taken as the measure of definite periods of time, or of year dates, but as symbols of the varied conditions of human life in the history of the Kingdom of Christ. The symbolism of numerals, given on page 58 and used in Ezekiel's Vision, is here applied. An exhaustive interpretation is not attempted; an effort, however, is made to show that the numerical symbolism of the Old Testament reappears in St. John's Vision. But no theory of numeric symbolism, however happy its solutions, can compass the full meaning of the numeric language of this marvellous Vision.

The Revelation consists of four principal divisions, each having seven scenes.

I. The word of the Spirit; seven voices to seven typical Churches in Asia.

II. The book of things to be revealed, under the cover of seven seals.

III. The sounding of trumpets; seven trumpets by seven angels.

IV. The pouring out of vials; seven vials.

The Spirit's admonition to the seven Churches is followed by a vision of Christian worship throughout the Christ-world, and in all ages of the Christian history. This is one aspect, and the number seven carries with it the idea of sufficiency — enough for God's purpose. In like manner the opening of the seals, the blast of the trumpets, and the pouring out of the vials, are each followed by a vision of victory, jubilation, and alleluia.

The first four seals appear to represent four great powers at work under Divine control.

1st. The white horse and his rider, symbolizing the spiritual power of Christ in his Kingdom.

2d. The red horse, representing the military power of nations.

3d. The black horse, with a pair of balances, representing civil power for the administration of justice.

4th. The pale horse, symbolizing sorrow, suffering, affliction, death. Christian history bears abundant evidence of the part these forces play in the unfolding of God's purpose.

The fifth seal reveals the patient integrity of real faith in Christ, and the sixth exhibits the overthrow of nations and dynasties that stand opposed to God's purpose, and also the fall of mighty men (stars) even in the Church, amidst the upheaval of earthly things.

Before the seventh seal is opened, a far-off vision of God's purpose is given in two parts: First, the gathering of all Israel into the Kingdom of Christ, symbolized by the mystical number one hundred and forty-four thousand, that is, $12 \times 12 \times 10 \times 10 \times 10$. The cube of ten is the symbol of full and complete contain-

ment, and twelve is the numeric symbol of the covenant; hence, twelve thousand stands for a whole tribe, and one hundred and forty-four thousand for the twelve tribes.

The second part reveals a great multitude, which no man can number, and these with all Israel cry with a loud voice, saying, "Salvation to our God, which sitteth upon the Throne, and unto the Lamb. These are they that have come out of great tribulation, and have washed their robes in the blood of the Lamb." This sudden transition, passing in quick review the bounds of ages, appears to be made that they who put their faith in Christ may be assured of victory and peace, notwithstanding the dreadful sorrow and peril that must come on the earth in God's conflict with sin and wickedness.

The Vision now returns to the opening of the seventh seal, which is announced with a great uplift of devotion and self-consecration to the service of God. The life of righteousness is cast into the world of human selfishness, injustice and wrong. The blast of trumpets signifies the immediate result,— strife, blood, desolation, the overthrow of mighty ones. The conflict of righteousness against oppression, injustice and wrong, does not find complete satisfaction in six blasts of trumpets; the seventh must come, but before the seventh is sounded, as before the opening of the seventh seal, there is a suspense, and a mighty angel appears, spanning the earth and sea, that is, human life; for the seventh trumpet shall not be sounded till the end shall come, when the mystery of God shall be finished. The voice of the seventh trumpet will say: "It is enough; this

contention with God must cease, and peace must reign upon earth;" but before the end, what does the Vision reveal?

The little book of mysteries, God's way on earth, is brought out. It must be read, marked, learned, and inwardly digested. "Eat it" is the strong language of the Vision. Thus far the Vision gives a picture of the conflict between Christ and the world. Now follows fierce assault upon Hebrew and Christian faith. Hebrew worship is sustained, but not fully. The Holy City, or people of Hebrew descent and faith, passes into possession of Gentiles to be oppressed, trodden under foot forty-two months. The assault does not stop here; the Christian household, the City of God, forecast in Ezekiel's Vision, is included in the hateful attack, but it is not unto death. The two witnesses bear testimony in sorrow, under the symbolic numbers one thousand two hundred and sixty days. One thousand is the symbol of completeness; two hundred, or 5×40, is the symbol of trial or discipline unto life; and sixty is 10×6, or full time. The whole signifies that the appointed trial, or discipline unto life, shall certainly be complete in its appointed time; in other words, let the worshipers of God keep faith with God; He will cause unbelief to give way to patient testimony to the truth: men will find that there is no peace apart from the loving companionship of God. The spirit of evil may hurt God's people, it cannot destroy them. God remembers the covenant He made with Abraham, and He will carry forward His creative work to its complete consummation. The Hebrew is not forgotten, but

the greater blessings along the way fall to them that believe in His Only Begotten Son, Jesus Christ. Sorrow comes in appointed times and ways; but it passes, and the seventh trumpet sounds the Spirit's call to come up to the Throne of Peace and Divine repose; for the Kingdoms of the World shall become the Kingdom of our Lord, and of His Christ, and the Prince of Peace shall reign forever.

The Vision again returns from the far-away scene to forecast the conflicts that shall arise within the Kingdom of the Prince. A great wonder is revealed in the likeness of a woman clothed with the sun and having a crown of twelve stars, and the moon under her feet. Woman represents Divine motherhood, God's bride; the crown indicates sovereignty; the sun Divine glory; the whole constitutes a vision of humanity when imbued with Divine Life Incarnate, and given dominion over the whole earth. A man-child is born of the woman. The spirit of wickedness stands ready to destroy the child, but he is caught up to heaven, and the woman, Divine motherhood, is given a concealed life, mystically termed one thousand two hundred and sixty days; that is, the life of sacrifice ordained for the Divine household shall have its full completion in its appointed time. The concealment, or flight of the woman, is again announced in the mystical terms, time, times, and half-time; that is, one cycle, two cycles, and a half cycle, altogether three and one-half cycles, or years, equal to 42 months or 1000, 200 and 60 days. These symbolic numbers respectively signify, fulfillment, appointed discipline and full time.

In the likeness of a leopard, bear and lion, hostility to the Christ-world from without is described as a beast of destruction; while the beast of division within is likened to a lamb rising up out of the earth and having the serpent's cunning to mislead the brethren into heresy and schism, and destroy the companionship and life of the Church. The mark of the beast is in the forehead or right hand, that is, in what men think or do, which leads to combinations for exclusive control of religious, industrial or civil affairs; thus the beast is a divider and a destroyer. But a limit is set to the destructive work symbolically represented by the numbers 600, 60 and 6. This is purely a time symbol, being decimal multiples of 6. It is the day of heresy which begins secretly, rises slowly, requires long time, 100 times 6, to reach full maturity, maintains dominant power a short time, 10 times 6, and suddenly falls, once 6: such is the record of any specific form of evil whether in civil, industrial, domestic or religious affairs. The forces of righteousness are slow to move, but when the time is fully ripe they move with overwhelming power. The number of the beast is the number of man, for the number of man A D M is 1 4 4, the numeric symbol of the twelve tribes, 12, and the measure of the city, and is equivalent to $6 \times 6 \times 6$ multiplied by .666.

Over against the vision of the destroyers is seen the Son of Man, the Lamb of God, standing upon the throne with his jubilant 144 thousand in expectation of the victory of the Prince over unrighteousness, injustice, oppression and wrong. The Vision then reveals a picture of the helplessness of them that are grown power-

ful through contentions against and within the Christ-world. In the symbolic seven vials of wrath, which stand for the overthrow of iniquity, we see the Divine sufficiency for the suppression of idolatry, false doctrines and the authors of confusion; Babylon falls. The white horse and his rider reappear, followed by a vast multitude clothed in white on white horses; it is the symbol of triumphant righteousness in Him that is alive forevermore, whose name is the Logos of God, King of kings and Lord of lords. The immediate result of this massing of the righteous activity of the Christ-world in solid unanimity and power is symbolized in the mystical term, Satan is bound a thousand years; not one thousand equinoctial years, but a cycle full and complete for God's purpose to make paramount on earth the reign of Christ the Only Begotten Son of God, who for us men came down from heaven and was made man, to whom power over all flesh is given, a day when human life on earth shall be filled with the glory of the Lord. A remarkable description of the millennial reign of Christ was made by Papias, Bishop of Hieropolis, Phrygia, second century, in numeric symbolism derived from the traditional sayings of Christ, thus: the vine bears 10000 branches, every branch 10000 twigs, every twig 10000 bunches, every bunch 10000 grapes, and every grape 36 times 25 gallons of wine. Now 10000 is the numeric symbol of the overflowing fullness and abundance that distinguishes the fertility of the vine, branches, twigs and bunches. But 36 times 25 gallons is 100 times 144 logs; the Hebrew log being the measure of oil pre-

scribed for the consecration of the High Priest, and containing 43.2 cubit digits or one-half pint, and 144 being the Adamic or man symbol A D M, 1 4 4 as in the numbering of all Israel 144000, the numeric symbolism 36 times 25 gallons of wine signifies the full and complete refreshment of consecrated human life. The whole numbering by Papias depicts in numeric symbolism the overflowing abundance of the Vine, the Christ-life of the millennial reign, the fruitage of the Second Adam. The date of such a consummation no man knoweth, for in no form whatever has it been revealed. But when it comes to pass, the whole earth will realize the blessedness of the life hid with Christ in God, the reign of peace and good will.

The Vision closes with a symbolic picture of the Divine ideal of companionship; it is the City of God lighted by the Sun of Righteousness. All this marvellous forecast of human history is traversed by a river of pure water, issuing from the Throne of God and of the Lamb, bearing on either side trees yielding fruit for the healing of the nations. It is the symbol of the Divine Life Incarnate, whose blessed influence lays hold of individuals, communities and nations.

This complex panorama of voices, horses, seals, trumpets and vials, is a life-like Vision of the struggle for righteousness and faith, going on through the ages, in the Church, in nations, communities and individual souls: the Brooding and Inspiring Spirit of the Most Holy triumphantly lifting the vast world of human life into the companionship of Imperishable Love. As the first chapter of Genesis may be termed the Philosophy

of Creation, so, in the language of St. Augustine, the Apocalypse is the "Philosophy of History."

The ideals I have taken to be symbolized by geometric forms and the cardinal numbers, will be recognized as fundamental elements of civilization. To some extent these symbolisms are amply sustained by historic records, as 1, 3, 4, 7 and 10; this implies the probability that the remaining numbers 2, 5, 6, 8 and 9 were specifically used as symbolic concepts. As to the direct application of this symbolism to the monumental work and ideals of the past, there is room for different conclusions, not necessarily contradicting but supplementing one another, even as in geometry an angle is variously described by the numeric measure of its sine, tangent and arc. No single formulary can express the whole of a truth, and no single interpretation of a Divine word or act can exhaust its meaning.

To admit that, in the physical order of creation, God has expressed in numeric form the eternal harmony of His own being, logically involves the admission that corresponding relations in the spiritual world are expressible in numeric terms; for fundamentally the Divine ideal of harmony is comprised in all that is Divinely generated. I have endeavored, in a somewhat stammering fashion, to trace certain aspects of that harmony, along the line of companionship, from the grouping of unattached particles of sand by the sea up through atomic relations, crystal forms, plant organisms, animal activity and human life to a conscious co-operation with Divine activity as a final necessity in God's creative

purpose. By numeric correlation of Divine activities in nature I have endeavored to show wherein the Divine ideal of harmony preserves a working continuity in its evolutions; from which I conclude that without the number concept the physical creation was impossible.

The number concept belongs to the earliest forms of written language, and I recognize it as God's gift to enable men to discover and lay hold of the Divine harmony of the physical world. In my analysis of ancient architectural forms I have endeavored to show how devoutly the gift was used by men to embody ideals of Nature's order and beauty. I have not dared to eliminate the number concept from the world-wide inspirational activity of God; it is inseparable from the teachings of Confucius, Buddha, Brahma, Moses, the Hebrew prophets, the life of Jesus and St. John's forecast of God's merciful purpose to bring all men into loving and cooperative companionship with Himself. Nor have I dared to limit the significance of numeric language to my own or to other men's interpretations, for in whatever way God expresses Himself in finite terms, we can only see it in part and as through a glass. In nature, art, religion and history God is manifested definitely by word and deed, by number and measure. To him who in faith and love works the golden vein of the Logos, its coinage will continually grow in richness and abundance.

Praise God from whom all blessings flow,
Praise Him all creatures here below,
Praise Him above ye heavenly host,
Praise Father, Son and Holy Ghost.

ASTRONOMICAL COINCIDENCES.

The following coincidences may be of interest in relation to the "star" seen by the wise men on reaching Bethlehem, inasmuch as two years earlier Jupiter had become exceedingly brilliant on account of his nearness to the earth.

Transits of the moon and Jupiter occurred at Washington, D. C., Feb. 3, 1899, at 5.35 and 5.36 A. M., the moon's transit at Bethlehem, Judaea, 35° 15′ East Long. being 15 minutes earlier, at 5.20 A. M., local time. A similar conjunction of transits occurred 1901 years and one week before, on the meridian of Bethlehem, Jan. 26, about 9 P. M. Astronomically the text, 'going before them till it came and *stood over* where the young child was,' describes the appearance of the "star" approaching its culmination on the meridian of observers arriving at Bethlehem about 9 P. M., Jan. 26, B. C. 3. If this coincidence be taken as the star of the Magi the order of events directly following the birth of Jesus may be, the birth Dec. 25, B. C. 4, the circumcision Jan. 1, B. C. 3, the visit of the Magi Jan. 26, the departure of the Magi Jan. 30, the presentation of the Child in the temple at Jerusalem Jan. 31, Joseph's departure for Egypt Feb. 1, by the direct road leading southwesterly from Jerusalem.

The 30 years' cycle observed by Jesus, according to Hebrew law, before entering upon his ministry, comprises 371 lunations, or 1565 weeks, which is the

numeric form of J H V H, 1 5 6 5. The cycle of his life from the Birth to the Ascension was 12181 days, equal to 412.5 lunations; the number 412.5 (the diameter of the circle whose circumference is 1296, the numeric symbol that expresses the compass of all things) may signify that the life of Jesus spanned the whole world of humanity. The cycle from his baptism Dec. 30, A. D. 27, to his crucifixion March 24, A. D. 31, comprises 40 lunations, the numeric symbol of discipline preparatory to a higher life. The cycle from his birth Dec. 25, B. C. 4, to his meeting the doctors in the temple in his 13th year, comprises 4462 days, equal to 430 times 10565, J H V H. A lunation is 29.530 solar days or 29.611 sidereal days; the mean of these measures is 29.57, therefore a quarter lunation is 7.392 which is 7 times 1.056, the satisfaction of J H V. A similar coincidence occurs in the volume of the earth, which is equal to a sphere whose diameter is 7 times 1131.3 miles, that is, the satisfaction of the Son of God, 2 times 565.65. The cycle from the full moon of the first month, the passover, to the full moon of the seventh month, feast of tabernacles, comprised 205.6 days, to which 6 days must be added to include the 7 days' feasting; thus from the passover to "that great day" of the feast when Jesus made his final claim of Divine Sonship, the cycle comprised 211.6 days or 2 times 105.6, the numeric symbol of the likeness or manifestation of J H V.

One-fifth of a circle is 4320′, the numeric symbol of full consecration; and one-fifth of the sidereal year is 73.25 sidereal days, or in round numbers 7 times 10.5,

the numeric form of J H, 10 5. The lunar cycle of 19 years is 235 lunations, which in round numbers is 15 times 15.65, the product of the numeric forms of J H and J H V H. The solar cycle of 25868 ± 5 years is 9 × 10000 times 105 days, which by numeric symbolism signifies the overflowing fullness 10000 of J H, 10 5, in the brotherhood, 9, of the stars. Thus in the language of numbers we may see the Creator's presence and handwriting on the scroll of the heavens.

APPENDIX.

THE GEOMETRY OF LETTERS.

THE letters used by ancient writers come to us in matured forms. Their development from crude beginnings may be traced in tablets, rolls and monumental inscriptions. Similar characters appearing in different languages may indicate tribal or international relations. Definite forms, when associated with definite ideals, become intelligible. Such are the frescoes of Egypt and the Orient; the story of a victory or sacrifice is given in a few strokes of the brush. In like manner letters combined in accordance with fixed laws or usage become words which are the symbols of a spoken language. The Greeks and Romans did their word-building with rigid observance of a law of construction. Relics of the remote past reveal the dominant influence of ideal symmetry, and we cannot doubt that the ancient makers of letters felt the breath of that inspiration. The geometry comprised in alphabetic forms may indicate symmetric ideals.

The letters a, c, e, g, o, s of the English alphabet are curved lines; f, h, i, j, l, m, n, r, t are vertical lines; v, w, x, y, z are sloping lines; b, d, p, q are curved and vertical lines combined; k is the combination of a vertical with sloping lines; u is a modified form of v. The modern letters of the Hebrew alphabet follow vertical and horizontal lines. The ancient Hebrew followed the Phoenician forms, which were sloping lines joined at acute angles. The Coptic letters were formed of vertical and curved lines.

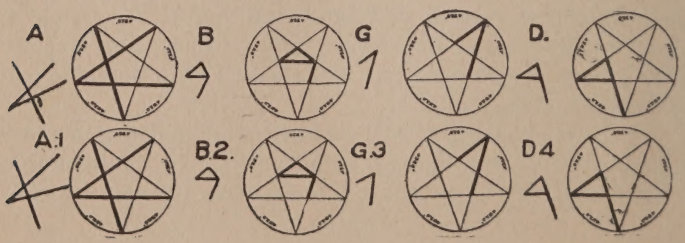
A close relation prevailed between letters and the number concept, the letter being used as a numeral; but between the number concept and geometric forms a closer relation was rec-

ognized: it may therefore be assumed that letter construction reached its maturity on geometric lines. The number five was generally held to be a sacred symbol which took the form of a star ✶ or the microcosmic man ★; the Phoenician letters closely followed its lines, as also did ancient Hebrew.

The first letter of the Hebrew alphabet is *aleph*, A L P, and like the Phoenician divided the circle into five parts, each part being 4320′; thus numerically it is the symbol of Holy Sovereignty, the one absolute unit, God. It may be observed that the numeric form of A L P, 1 3 8, is integrally equal to 21600 ÷ 1565, J H V H. The second Hebrew letter is *beth*, the form of an open porch, which signifies a house, hence offspring, progeny; its numerical value is two, the symbol of sonship. Its ancient form was that of a seed with pendant root or stem. The third Hebrew letter is *gimel*, G M L. The noun G M L is camel, and the letter form is compared to a camel's hump; but inasmuch as three was reverenced by all Oriental peoples as the symbol of Divine perfection, the name *gimel* might be referred to the verb G M L which signifies to give, to do good; thus the letter would represent the Giver of all good things. These illustrations might be extended much farther to show a close connection between the letter form and the number concept. Characters in written language have a wide significance and it would be unsafe to set a narrow limit to their value as symbols of things, actions or ideals.

PHOENICIAN AND ANCIENT HEBREW ALPHABETS.

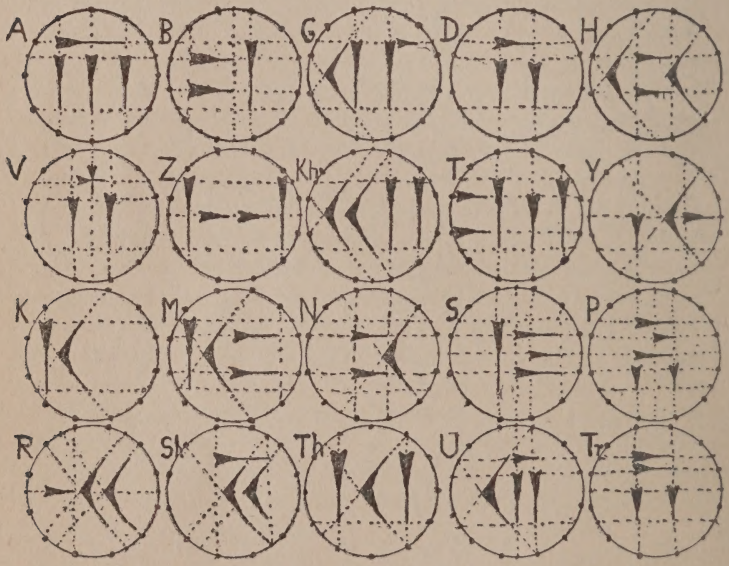
The numeric symbols of the Hebrew letters are given.



H
V.
Z.
Ch.
H.5.
V.6.
Z.7.
Ch.8.
T.
I
K.
L
T.9.
I.10.
K.20.
L.30.
M
N.
S.
E.
M.40.
N.50.
S.60.
E.70.
P.
Ts
Q
R.
P.80.
Ts.90.
Q.100
R.200
Sh.
Sh.300.
Th.
Th.
400

CUNEIFORM LETTERS.

The following chart shows a remarkably close relation between the duodecimal division of the circle and the position of the wedges as they were arranged to form the cuneic letters according to the Persian system.



The following method appears to have been observed for the combination of wedges in this system.

1 wedge	with	2	wedges,	b. d.
1 "	"	3	"	a. s.
2 "	"	2	"	v. z. tr.
2 "	"	3	"	t. p.
1 yoke	"	1	"	k.
1 "	"	2	"	y. n. th.
1 "	"	3	"	g. u. m.
2 "	"	1	"	r. sh.
2 "	"	2	"	h. kh.

There were duplicate forms of k (1 wedge with 2 wedges), m and r (1 wedge with 3 wedges), and i (2 wedges with 2 wedges), not shown in the table.

The yoke is formed by two wedges joined at an angle of about 120°, one third of the circle, the measure of an equilateral triangle, which Plutarch says was, in ancient Greek idealism, a geometric symbol of Truth ("De Defect.," chap. 22): "There are 183 worlds; they were arranged in the figure of a triangle, and every side contained 60 worlds, the remaining three occupy the corners; in this order they gently touch each other and ceaselessly revolve as in a dance. The space within the triangle is to be regarded as a common hearth for all and is called the field of Truth. Within lie, motionless, the causes, forms and original images of all things which have been and which shall be. Eternity surrounds them, from which Time, as an effluence, flows over the worlds. Human souls of transcendent excellence obtain permission, every thousand years, to contemplate the spectacle, and the most glorious mysteries on earth are simply dreams (*ideals*) of such contemplation." It figures the realm of the Infinite, the perfection of Divine activity in nature, art, religion and history.

LEVELS IN THE GREAT PYRAMID.

Mr. Petrie's survey of levels affords the following coincidences: —

Inches.	
0.	S. E. socket and geometric base.
1732.7 ± .6	King's Chamber, floor.
1732.5	= 8 times 10.5 cubits. Life, J H.
1732.5	= 84 cubits = 7 times 12. Rest, Covenant.
17326′	= 1443.9 × 12. Solar-sidereal time, Zodiac.
892.5 ± .3	North-end, Gallery floor.
891.0	= 43.2 cubits. Consecration. A cubit is 5 × 5.65 digits, and is a symbol of Divine sovereignty.
892.1	= 8 times 10.56^2. Life, Kingdom of J H V.

Inches.

705.9 ± .1 Beginning of entrance passage.
704.8 = .6666 times 1056. Time, J H V.
704.3 = 5 × 1056 × $.36524^2$. Sovereignty, J H V, Day.
703.8 = 5^2 × 1.365 cubits. Sovereignty, A L O H.

1962.5 ± .6 King's Chamber, roof.
1961.1 = 9 times 10.565 cubits. Ideal companionship, J H V H.

1881.5 ± .6 Ante-chamber, roof.
1882.0 = 365 × 5^2 cubits. Day, Reign of Law.

874.4 ± .4 Queen's Chamber, floor.
876.5 = 365.24 × 2 × 12. Day, Son, Covenant.

39.9 Pavement, floor.
40.0 = 3 × 3.6524^2. Divine day or light.

5776.0 ± 7. Apex above pavement.
5775.6 = 4 times 1443.9. House, Solar day in 'sidereal time.' Mean solar day is 1440 minutes. The sidereal day is 1436.1 minutes; this divided by 1440 would give .997 for a 'sidereal minute,' therefore 1440 ÷ .997 = 1443.9 'sidereal minutes' in a mean solar day.

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